Friden

CALCULATOR & ADDING MACHINE

ADJUSTMENT MANUAL

Friden, Inc.
SAN LEANDRO, CALIF

CALCULATOR AND ADDING MACHINE ADJUSTMENTS
FOR
HW-DW-CW-SW-STW-ACG-SRW-SBT-STQ-SBQ-SRQ AND ALL GRAYLINE MODELS
AB AND AC ADDING MACHINES

PREFACE

This revised Calculator and Adding Machine Adjustment Manual obsoletes and supercedes all adjustment manuals previously issued for the above listed machines.

●

All adjustments have been revised and updated to the latest Factory specifications.

●

The manual has been designed for greater convenience in carrying and for quick easy reference to the specific adjustment being checked.

●

Index tabs separate the manual into sections pertaining to specific mechanical functions or features. Each section contains only those adjustments that apply to a particular machine function or feature.

●

Many of the adjustments formerly titled and numbered as individual adjustments have been combined into sequence adjustments. The adjustment title explains the overall objective; while the accompanying numbered illustrations and text outlines the sequence steps to be followed in making or checking the adjustment.

●

Adjustment identification for specific model machines is no longer used. Instead, identification is based on the machine feature or function. If not so identified, the adjustment is considered basic to all models (see note).

●

Adjustment clearances are established by the Engineering Department for use by the Assembly and the Service Departments. Since the main purpose of the adjustments is to place the machine in proper operating condition, the adjustments are to be held as close as possible to the specified clearances. However, as wear develops it may be necessary to vary the adjustments from their original settings to obtain the desired results.

●

When possible to do so, use a feeler gauge to check adjustment clearances.

●

NOTE: The basic calculator consists of those parts and assemblies required for keyboard selection, right and left carriage shift, and plus and minus operation. To this basic machine are added the necessary parts and assemblies for accomplishing multiplication, division, square root, squaring, back transfer, etc. Therefore, certain adjustments are basic to all models, while adjustments for the added parts and assemblies are covered in their respective section of the manual.

5-15-63

Friden, Inc.

HOME OFFICE CORRESPONDENCE
SAN LEANDRO, CALIFORNIA

TO ALL FRIDEN OFFICES
FROM RUSS KETCHUM
DATE 9 - 4 - 64

SUBJECT CALCULATOR & ADDING MACHINE ADJUSTMENT MANUAL (Grey small)

Please insert the attached pages in your Calculator and Adding Machine Adjustment Manual. Additional pages may be ordered from San Leandro Parts Department. Check your manual with contents pages 1, 2, and 3 Rev. 8-15-64 to insure you have received all pages. These adjustments were revised to update your manual to current manufacturing adjustments.

IMPORTANT

It has also been brought to our attention that a misunderstanding on the new manual exists with our technicians. They feel the new manual is a condensed version of the old manual. This is not true as the new manual has revised adjustments and was made to replace the old manual which had become obsolete.

In the new manual, adjustment sequences are in the proper order to apply to all equipment. Some of the basic adjustment tolerances were revised for new models such as the SBT, SRQ, etc.

The revised adjustments are listed below and should be reviewed by all Calculator Service Technicians.

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Adj. 6 Fig. 1

Section 2

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Adj. 2 Fig. 2

Section 3

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Adj. 3 Fig. 1, 2, 3, 4, & 5

Section 4

Adj. 2

Section 5

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Adj. 9 Fig. 2

Section 9

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Section 11

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Section 12

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FRIDEN CALCULATOR ADJUSTMENTS

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ADJ. 1 - TIMING & ADJUSTMENT OF DRIVE SHAFT ASSEMBLY

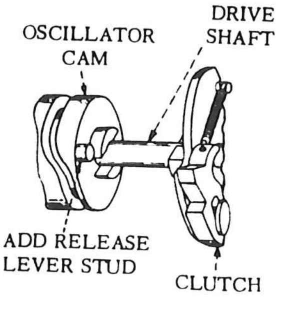

Fig. 1

FIG. 1 - DRIVE SHAFT HOME POSITION

Rotate the drive shaft until the add release lever stud (or new style cam) is facing up and to the front of the machine. The clutch is then installed with its clutch dog to the front of the machine and engaged with the clutch release dog.

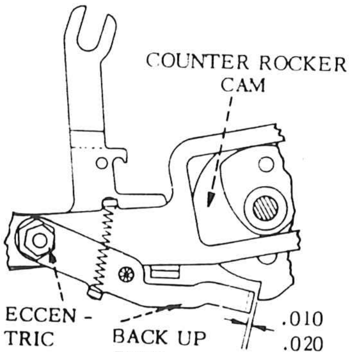

Fig. 2

FIG. 2 - DRIVE SHAFT BACK-UP-PAWL

With the drive shaft in home position, there is to be .010" to .020" clearance between the back up pawl and the counter rocker cam. To adjust, turn the eccentric as required.

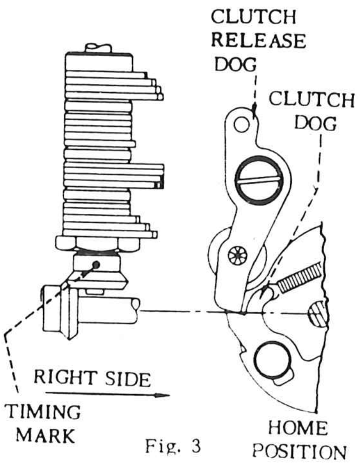

Fig. 3

FIG. 3 - ACTUATOR TIMING

With the drive shaft in home position, install the actuators so that the timing marks are pointed straight up.

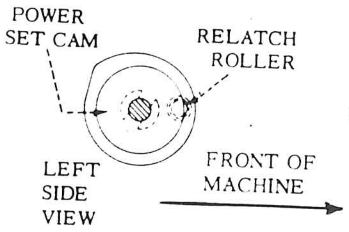

Fig. 4

FIG. 4 - POWER SET CAM

With the drive shaft in home position, install the power set cam with its relatch roller facing the front of the machine.

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ADJ. 1 -TIMING & ADJUSTMENT OF DRIVE SHAFT ASSEMBLY

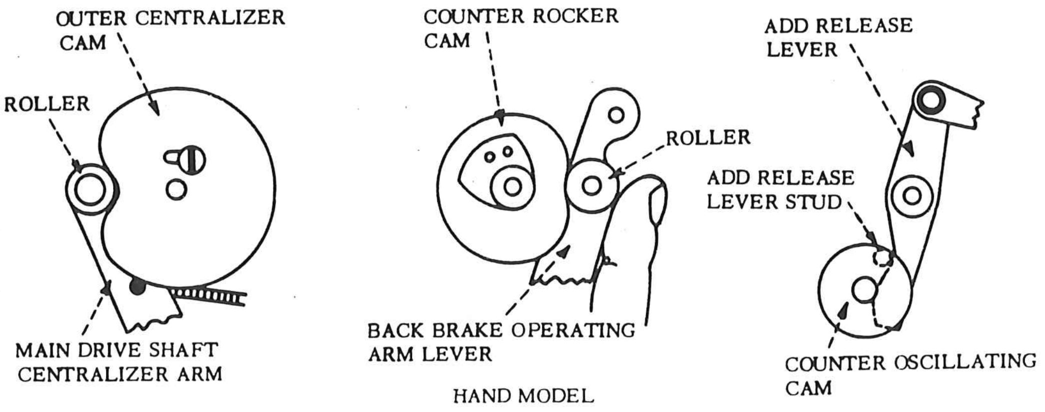


Fig. 5

FIG. 5 - DRIVE SHAFT CENTRALIZER (Hand Models)

On hand model machines, the home position of the drive shaft is set as follows: (1) Apply pressure against the back brake operating arm lever so the roller is riding in the notch of the counter rocker cam. The add release lever stud will then be positioned as shown. (2) Before tightening the screw in the centralizer cam, rock the cam back and forth to allow the roller on the main drive shaft centralizer arm to ride in the notch of the cam. Tighten the screw and check to see that the drive shaft rotates freely and centralizes properly.

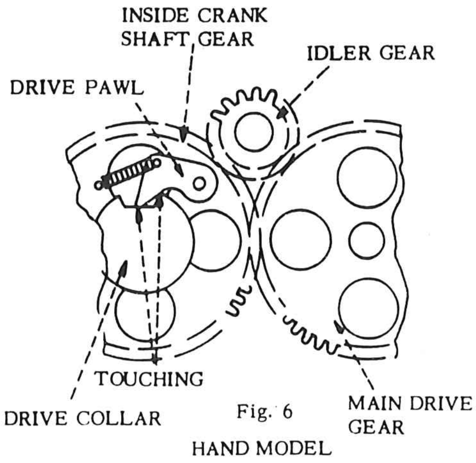


Fig. 6

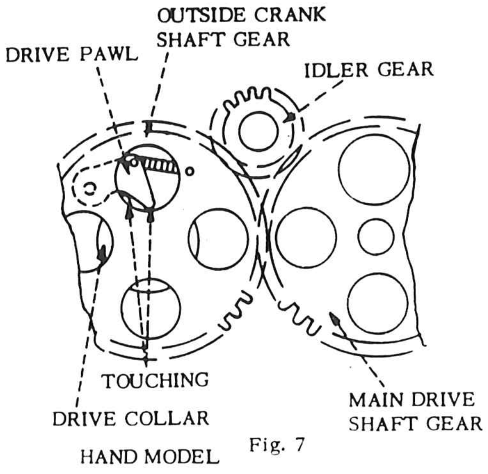


Fig. 7

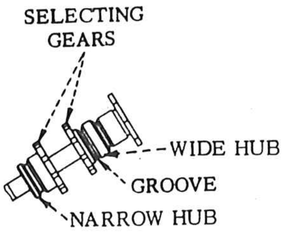
FIG. 6 - INSIDE CRANK SHAFT GEAR

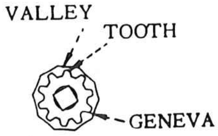
With the drive shaft in home position and the drive collar centralized, install the main drive gear into mesh with the inside crank shaft gear and idler gear making sure that the drive pawl is touching on the drive collar.

FIG. 7 - OUTSIDE CRANK SHAFT GEAR

With the outside crank shaft gear installed, make sure the drive pawl is touching on the drive collar at points shown.

ADJ. 2 - SELECTING GEARS AND SHAFTS





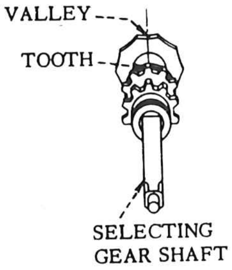


FIG. 1-10 COLUMN "W" LINE
INSET - 8 COLUMN "W" LINE

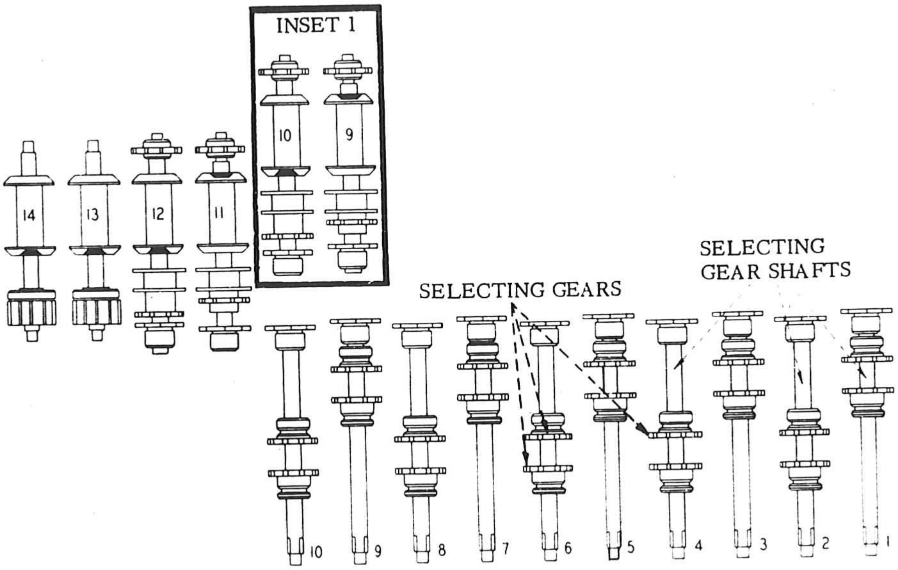


Fig. 1

FIG. 2 - 10 COLUMN GREY LINE WITH EXTRA TRANSFER
INSET - 8 COLUMN GREY LINE
10 COLUMN GREY LINE WITHOUT EXTRA TRANSFER

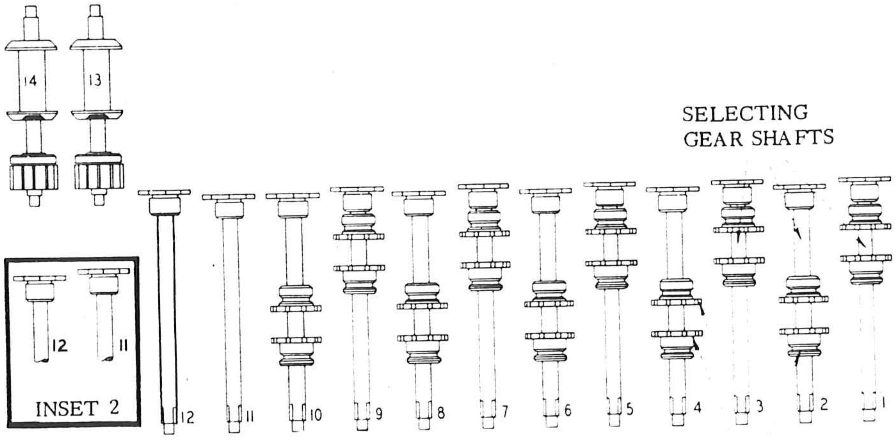


Fig. 2

SELECTING GEARS

ADJ. 2 - SELECTING GEARS & SHAFTS

FIG. 1 - 10 COLUMN "W" LINE

ORDER	SHAFT LENGTH	SELECTION GEAR POSITION		SELECTION GEAR TIMING	
		WIDE HUB	NARROW HUB	TOOTH TO TOOTH OF	TOOTH TO VALLEY OF
1st	Long	Facing Rear	Facing Front	Selection Gear	Geneva
2nd	Short	"	"	"	"
3rd	Long	"	"	"	"
4th	Short	"	"	"	"
5th	Long	"	"	"	"
6th	Short	"	"	"	"
7th	Long	"	"	"	"
8th	Short	"	"	"	"
9th	Long	"	"	"	"
10th	Short	"	"	"	"
11th	Special Assembly (Ident. Groove) Geneva pressed on to give the short Geneva order.				
12th	Special Assembly - Geneva pressed on to give the long Geneva order.				

INSET 1 - 8 COLUMN "W" LINE

9th	Special Assembly (Ident. Groove) - Geneva pressed on to give the long Geneva order.
10th	Special Assembly - Geneva pressed on to give the short Geneva order.
11th	Special Assembly (Ident. Groove) - Geneva pressed on to give the short Geneva order. Same as 10 Column.
12th	Special Assembly - Geneva pressed on to give the long Geneva order. Same as 10 Column.

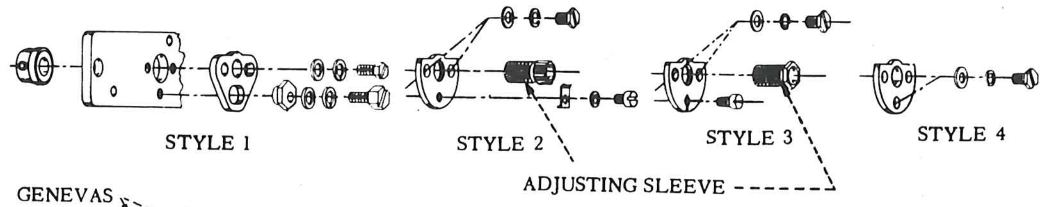
FIG. 2 - 10 COLUMN GREY LINE WITH EXTRA TRANSFER

1st	Long	Facing Rear	Facing Front	Selection Gear	Geneva
2nd	Short	"	"	"	"
3rd	Long	"	"	"	"
4th	Short	"	"	"	"
5th	Long	"	"	"	"
6th	Short	"	"	"	"
7th	Long	"	"	"	"
8th	Short	"	"	"	"
9th	Long	"	"	"	"
10th	Short	"	"	"	"
11th	Short	none	none	none	none
12th	Long	none	none	none	none

INSET 2 - 8 COLUMN GREY LINE
10 COLUMN GREY LINE WITHOUT EXTRA TRANSFER

9th	Long	8 Column none	none	none	none
10th	Short	10 Column Facing Rear	Facing Front	Selection Gear	Geneva
11th	Long	none	none	none	none
12th	Short	none	none	none	none

ADJ. 3 - ACTUATORS AND GENEVAS



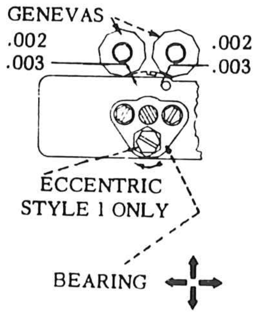


Fig. 1

FIG. 1 - GENEVA CLEARANCE

There is to be .002" to .003" clearance between the genevas and the Geneva transfer stops. To adjust, raise or lower the actuator bearing as required. Note: Due to eccentricity of the genevas and actuators, the clearance is to be set to the highest side of the genevas. Check the adjustment on all ten points. After adjusting the (style 1) actuator bearing, be sure to rotate the holding eccentric clockwise and tighten securely. This eccentric is not an adjustment means, but only to prevent the adjustment from slipping.

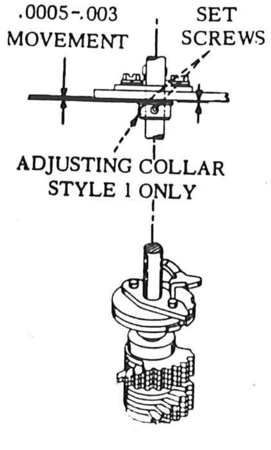


Fig. 2

FIG. 2 - ACTUATOR END PLAY

The actuators are to have no more than .0005" to .003" end play. To adjust, loosen the drive shaft thrust bearing and proceed as follows:

Style 1 - Move the adjusting collar forward or rearward and tighten the set screws.

Style 2 - Rotate the adjustable sleeve in or out, and then install and secure the detent.

Style 3 - With the upper left screw loose and the locking screw backed out slightly, rotate the adjustable sleeve in or out as required. Tighten the lower screw to lock the sleeve and then tighten the upper left screw.

Style 4 - Remove the actuator bearing and either install 4024 shims on the actuator shaft to remove end play, or install 4024 shims between the bearing and the support bar if actuator is too tight.

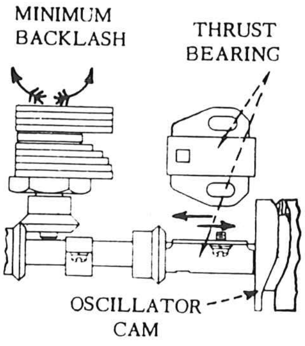


Fig. 3

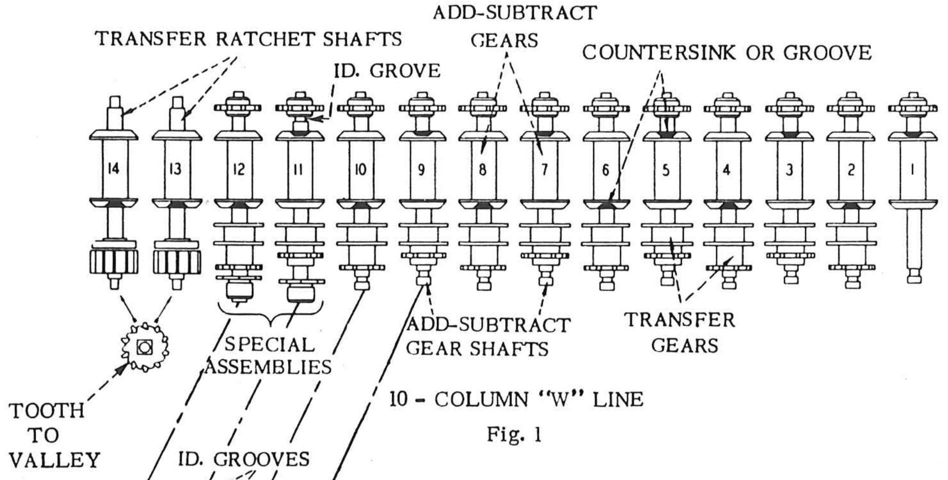
FIG. 3 - ACTUATOR BACK LASH

There is to be minimum back lash between the actuator miter gears and the drive shaft miter gears; yet the actuators and drive shaft must rotate freely. To adjust, move the drive shaft and the thrust bearing to the right as far as possible and tighten the thrust bearing screws. Check the actuators by "rocking" them back and forth. It may be necessary to tap the drive shaft to the left slightly until the actuators rotate freely. Tighten the screws in the thrust bearing securely and check to see that the drive shaft has NO END PLAY.

NOTES:

1. The long Transfer Pin on 8 Column Machines is in the 11th Position.

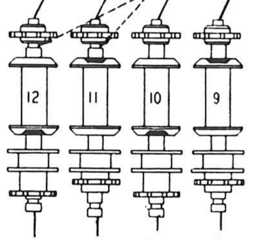
ADJ. 4 - TRANSFER GEARS, ADD-SUBTRACT GEARS & SHAFTS



10 - COLUMN "W" LINE

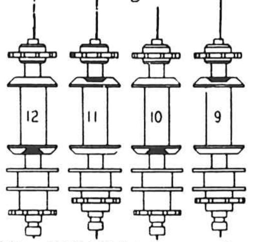
Fig. 1

NOTE: SHAFTS MUST BE FREE TO ROTATE AFTER INSTALLED



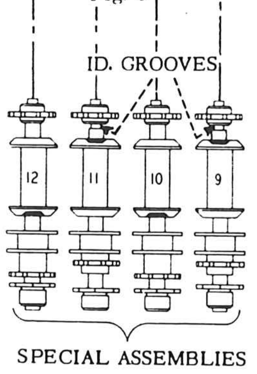
10 - COLUMN "GRAY"

Fig. 2



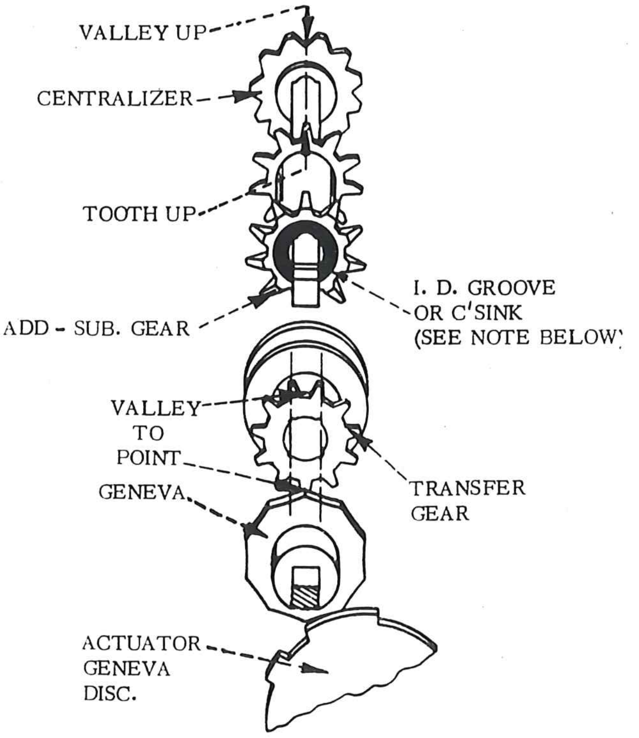
8 & 10 - COLUMN "GRAY"
WITHOUT EXTRA TRANSFER

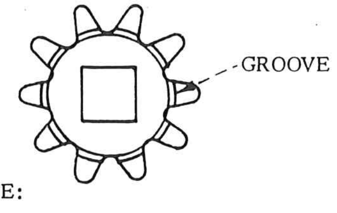
Fig. 3



8 - COLUMN "W" LINE

Fig. 4





NOTE:

NEW ADD - SUBTRACT GEAR
HAS A GROOVE RATHER THAN
A COUNTERSINK

ADJ. 4 - TRANSFER GEARS, ADD-SUBTRACT GEARS & SHAFTS

ORDER	ADD-SUB SHAFT LENGTH	ADD-SUBTRACT GEAR		TRANSFER GEAR		Add-Subt. Gear Tooth and Centralizer Valley
		Counter Sink	Tooth to Valley of	Length	Tooth to Valley of	
1st	Short	Up	Centralizer	None	-----	Straight up
2nd	Long	Down	"	Long	Geneva	"
3rd	Short	Up	"	Short	"	"
4th	Long	Down	"	Long	"	"
5th	Short	Up	"	Short	"	"
6th	Long	Down	"	Long	"	"
7th	Short	Up	"	Short	"	"
8th	Long	Down	"	Long	"	"

FIG. 1 - ALL MODELS 1st THROUGH 8th COLUMN ABOVE; 9th THROUGH 14th COLUMN BELOW

9th	Short	Up	"	Short	"	"
10th	Long	Down	"	Long	"	"
11th	Special Assembly (Ident. Groove)	Up	"	Short	"	" Geneva pressed on to give the short Geneva order.
12th	Special Assembly	Down	"	Long	"	" Geneva pressed on to give the long Geneva order.
13th	Special Ratchet	Down	Ratchet	None		
14th	Special	Down	Ratchet			

FIG. 2 - 10 COLUMN 'GREY' LINE WITH EXTRA TRANSFER

9th	Short	Up	"	Short	"	"
10th	Long	Down	"	Long	"	"
11th	Special Long (Ident. Groove)	Up	"	Short	"	"
12th	Special Short (Ident. Groove)	Down	"	Long	"	"

FIG. 3 - 8 & 10 COLUMN 'GREY' LINE WITHOUT EXTRA TRANSFER

9th	Special Assembly (Ident. Groove)	Up	"	Short	"	" Geneva pressed on to give the long Geneva order.
10th	Special Assembly	Down	"	Long	"	" Geneva pressed on to give the short Geneva order.
11th	Special Assembly (Ident. Groove)	Up	"	Short	"	" Geneva pressed on to give the short Geneva order.
12th	Special Assembly	Down	"	Long	"	" Geneva pressed on to give the long Geneva order.

FIG. 4 - 8 COLUMN 'W' LINE

9th	Special Assembly (Ident.Groove) - Geneva pressed on to give the long Geneva order.
10th	Special Assembly - Geneva pressed on to give the short Geneva order.
11th	Special Assembly (Ident.Groove) - pressed on to give the short Geneva order.
12th	Special Assembly - Geneva pressed on to give the long Geneva order.

ADJ. 5 - TRANSFER TOOTH AND RESTORE ARM

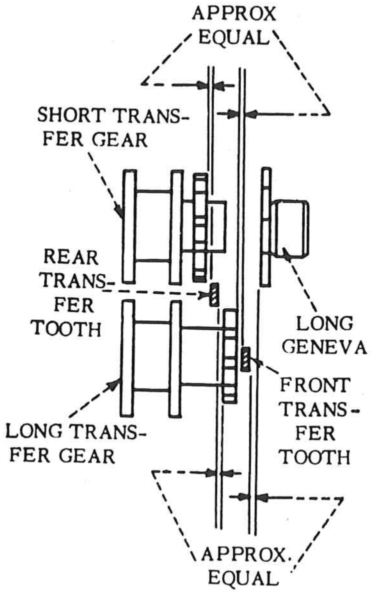


Fig. 1

FIG. 1 - TRANSFER TEETH CLEARANCE

The transfer teeth on the actuators must pass between the transfer gears and genevas with equal clearance at all 4 points. To adjust, form the transfer teeth as shown in the inset.

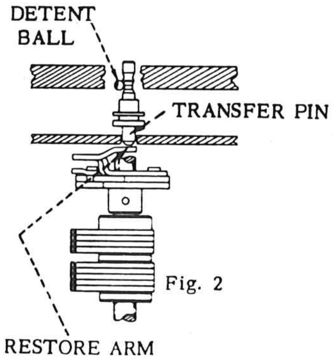
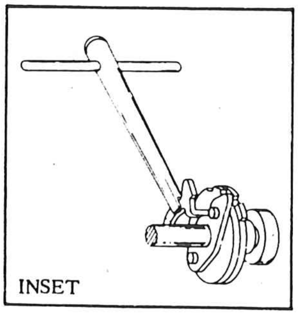


Fig. 2

FIG. 2 - TRANSFER RESTORE ARM

The transfer restore arm must fully restore the transfer pin to its detented position. To adjust, form the restore arm. Note: These parts are easily cracked or broken if formed excessively. Use extreme care when making the adjustment.



ADJ. 6 - MOTOR

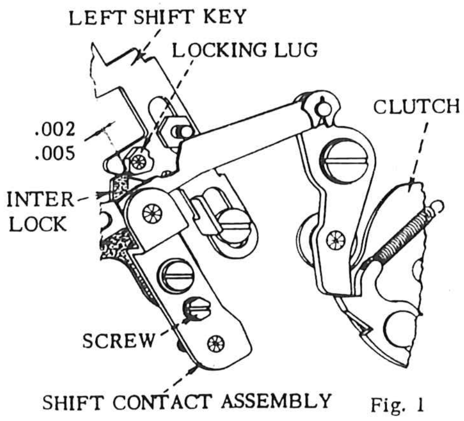
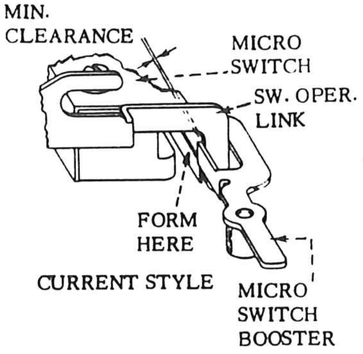


Fig. 1

FIG. 1 - SWITCH CLOSING AND KEY LATCH

The closing of the motor switch contacts and starting of the motor is adjusted to the left shift key; therefore, it is necessary that the shift key latch be adjusted prior to adjusting the switch. To adjust, have the drive shaft in home position. Then loosen the screw and move the shift contact assembly so the locking lug clears the interlock with .002" to .005" clearance. After adjusting, check to see that the key is held depressed when the drive shaft is half-cycled.

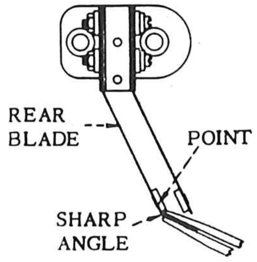


CURRENT STYLE

FIG. 2 - MOTOR SWITCH CONTACTS

The micro switch is to close as soon as possible on depression of any operating key, also the motor is to stop on the slow release of all operating keys. To adjust, form the micro switch blade.

Note: On machines with enter dividend and a micro switch booster, check for minimum clearance between the operating link and the booster. Form the booster lever as required.



OLD
STYLE

Fig. 2

FIG. 2 - MOTOR SWITCH CONTACTS (Old Style)

On machines with the old style switch contacts, the contacts are to be formed as illustrated before installing them. Then adjust to operate with the left shift key as described above.

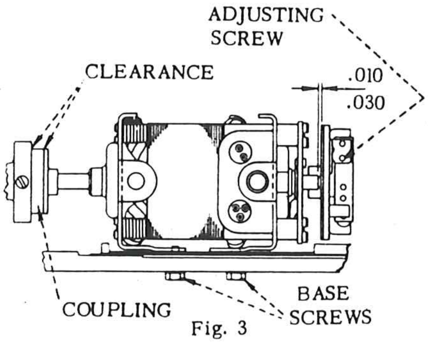


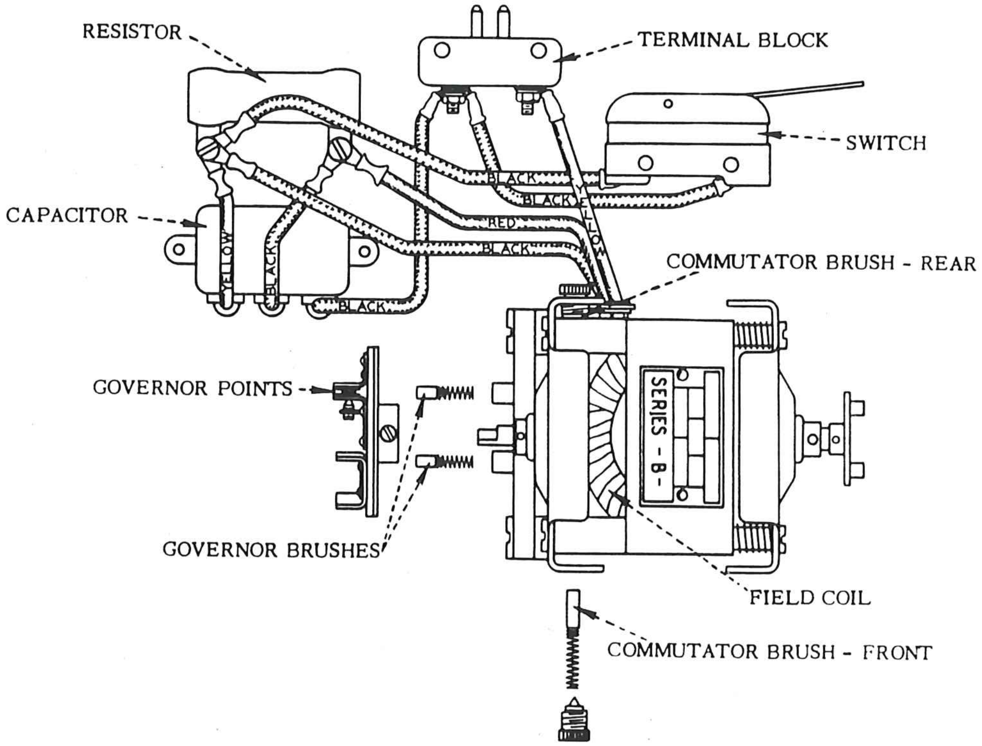
Fig. 3

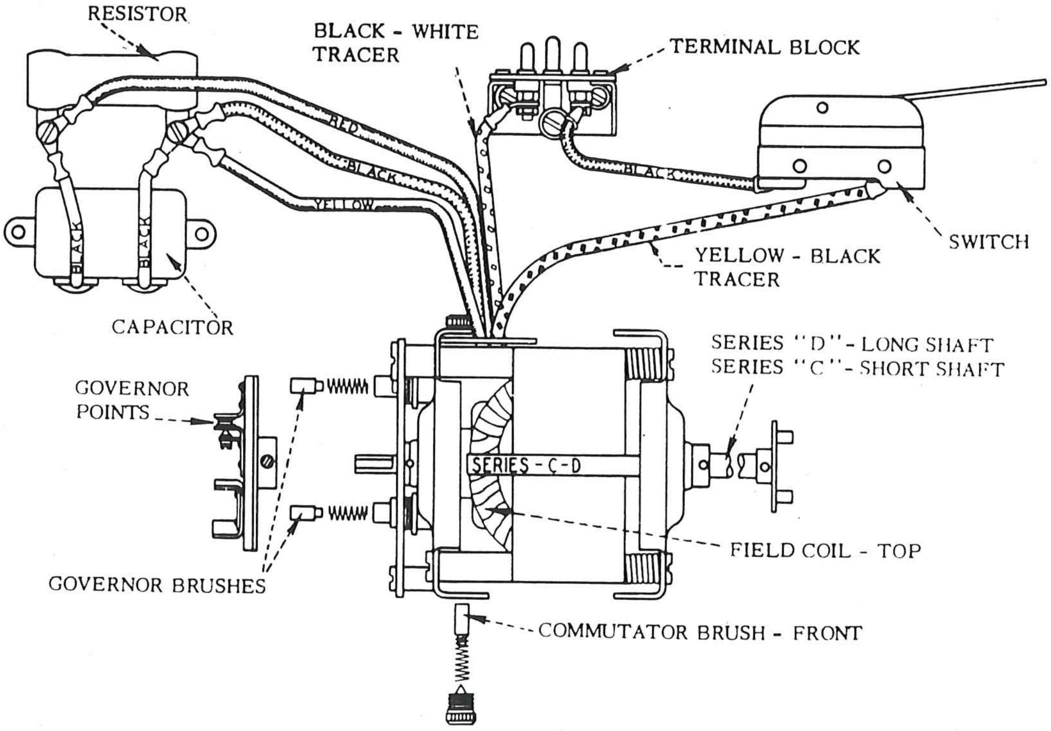
FIG. 3 - MOTOR SPEED -- ALIGNMENT -- SLIP CLUTCH

With the drive shaft gear train locked and the motor switch contacts closed, the motor is to start and cause the slip-clutch to slip (buzz). The motor is not to set and "hum". To adjust, turn the slip-clutch adjusting screw in or out as required. Then secure the screws by peening the edge of the screw holes.

On current model machines, the drive shaft is to rotate at 495 to 500 rpm. Grayline models at 480 to 490 rpm, and green case models at 450 rpm. To adjust, open or close the governor points by means of the adjusting screw. Note: The governor is to clear the brush holders by .010" to .030". Also, the motor is to be aligned for minimum vibration.

MOTOR WIRING





ADJ. 7 - TIMING OF DIVISION DRIVE GEAR AND DIVISION IDLER GEAR

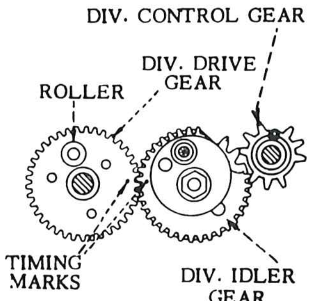
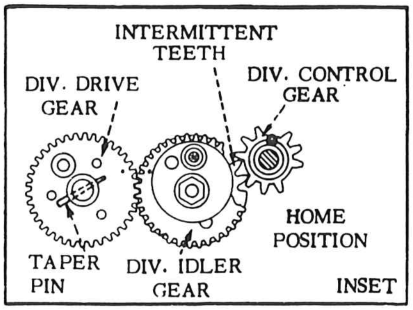


Fig. 1



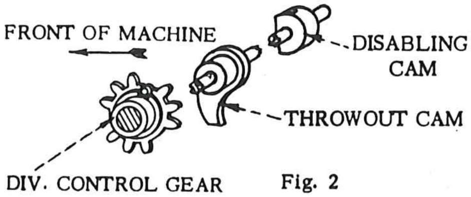


Fig. 2

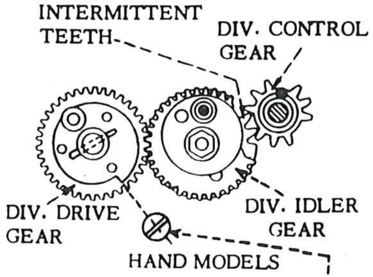


Fig. 3

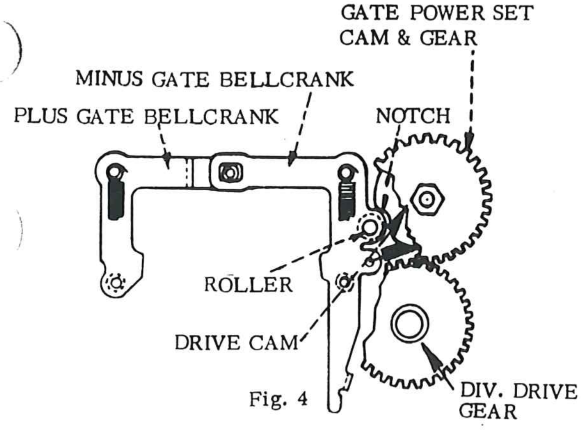


Fig. 4

FIG. 1 - DIVISION IDLER GEAR

Install the division drive gear and the division idler gear with their timing marks aligned. Then align the taper pin hole in the drive shaft with the hole in the drive gear hub so the pin can be driven in from the top.

INSET - HOME POSITION

When the drive shaft is in home position, the large end of the taper pin will be facing downward and to the front of the machine; the division idler gear will be in the position shown; and the intermittent teeth will be centered in the wide space on the division control gear.

FIG. 2 - CONTROL GEAR AND DISABLING CAM

When the division control gear is in home position (notch on gear seated over stop pin), the high point of the division throwout cam is to be pointed downward and the flat side of the disabling cam is to face the front of the machine. With the control gear and the cam positioned as shown, install the taper pin from the bottom side of the control gear.

FIG. 3 - DIVISION IDLER GEAR (Hand Models)

With the drive shaft in home position, install the division drive gear and the division idler gear so the point of the "lip" on the overthrow cam aligns with the center of the screw head and the intermittant teeth are centered in the wide space on the division control gear. Then align the taper pin hole in the drive shaft with the hole in the drive gear hub so the taper pin can be driven in from the top.

FIG. 4 - GATE POWER SET CAM & GEAR

The roller on the minus gate bellcrank MUST fit in the notch on the drive cam so the roller will be immediately picked up on the first motion of the drive cam.

Note: The timing marks on the division drive gear and the gate power set cam and gear are to be ignored for this adjustment.

KEYBOARD SELECTION

ADJ. 1 - SELECTION

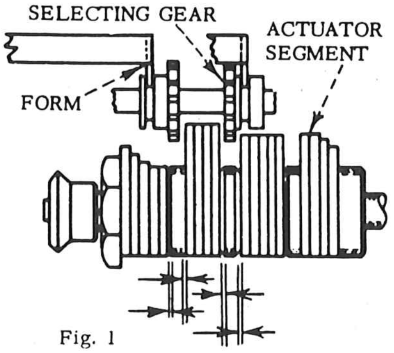


Fig. 1

FIG. 1 - SELECTING GEAR NEUTRAL CLEARANCE

When the selecting gears and arms are in home or neutral position, the selecting gears are to have equal clearance to the actuator segments. To adjust, form the yokes on the selecting arms forward or rearward as required. Also, adjust the selecting arms up or down so the yokes engage the grooves in the selecting gears deep enough to prevent disengagement but that they do not bottom and cause a bind.

Note: On back transfer and square root models, this adjustment is to be held as close as possible and should not be changed.

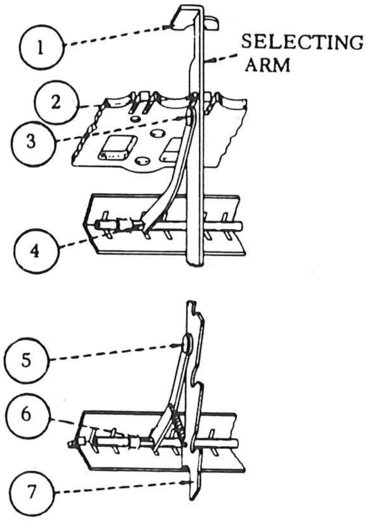


Fig. 2

FIG. 2 - SELECTING ARMS

After the selecting gear neutral clearance is adjusted as above, check each selecting arm for FREE movement, by pulling the selecting arm down and then slowly allowing it to restore while still holding the finger on the arm. If any bind or drag exists, check the selecting arm at the 7 points shown and form the arm as necessary to free it up.

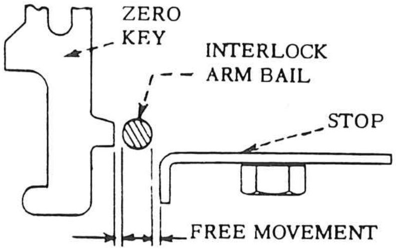


Fig. 3

FIG. 3 - INTERLOCK BAIL (Back Transfer Model)

With the keyboard out of the machine, check the interlock bail to see that it doesn't contact the numeral keystems. Then pull up on the individual column lock and check for free movement of the interlock arm bail between the stop and the extension of the individual column lock. To adjust, move the stop.

Continued On Next Page

KEYBOARD SELECTION

ADJ. 1 - SELECTION

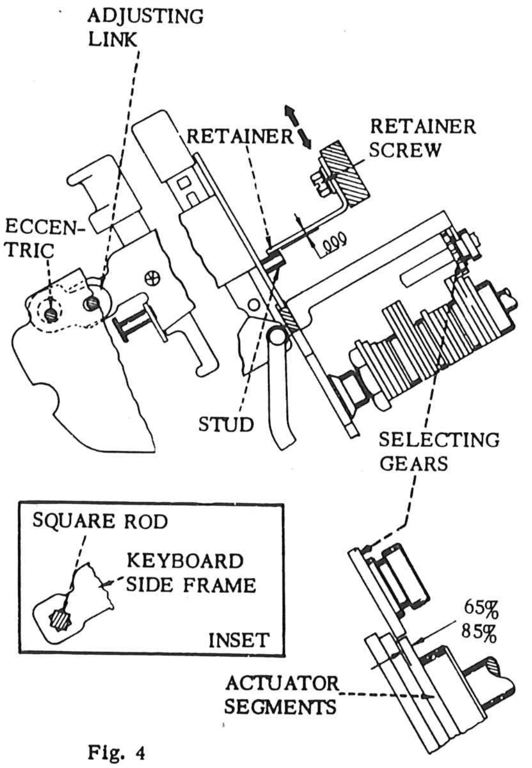


Fig. 4

FIG. 4 - ENGAGEMENT OF SELECTING GEARS ("W" models)

When a selecting gear is actuated by its selecting arm, the selecting gear is to engage the actuator segment with a 65% to 85% bite. To adjust, loosen the screw on each end of the square rod and move the keyboard forward or rearward with the eccentrics. Then move the keyboard retainer at the rear of the keyboard for no clearance to the stud. Check the selection by using 2's and 6's, 3's and 7's, and 4's and 8's.

Note: Once the keyboard is adjusted it can be removed without disturbing the adjustment. Be sure to rotate the square rod at an angle to secure the adjustment.

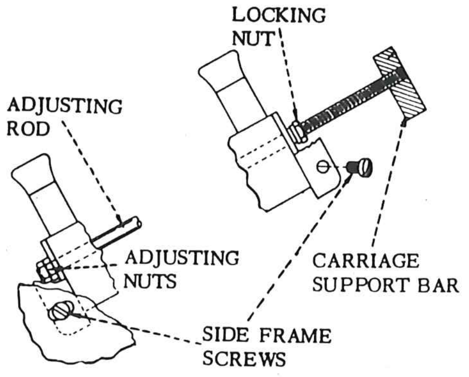


Fig. 5

FIG. 5 - ENGAGEMENT OF SELECTING GEARS (Gray Line Models)

The engagement of the selecting gears with the actuator segments is the same as shown in Fig. 4 (65% to 85%). To adjust, loosen the keyboard side frame screws and the two locking nuts but leave the adjusting nuts tight. Turn the adjusting nuts on the adjusting rods an equal amount to run the adjusting rod in or out of the carriage support bar. The keyboard is moved forward or rearward as required to obtain the proper selection. Then tighten the locking nuts and the side frame screws.

ADJ. 2 - KEYBOARD CLEAR

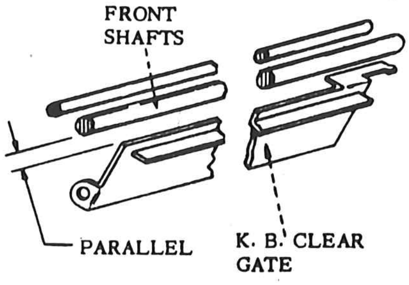
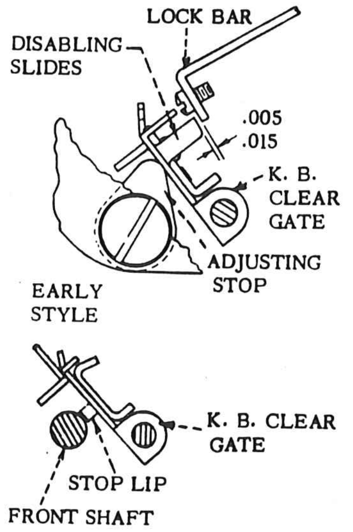


Fig. 1

✓ FIG. 1 - KEYBOARD CLEAR GATE

The keyboard clear gate is to be parallel to the front shafts. To adjust, twist the keyboard clear gate.



REVISED STYLE

Fig. 2

✓ FIG. 2 - KEYBOARD CLEAR GATE AND DISABLING SLIDES

There is to be .005"-.015" clearance between the keyboard clear gate disabling slides and the column lock bars. To adjust: (Early Style), rotate the adjusting stop. (Revised Style), form the stop lip. Note: When the zero key is raised, the disabling slide is to pass under the lock bar with clearance. SOMETIMES it is necessary to form the disabling slide up or down.

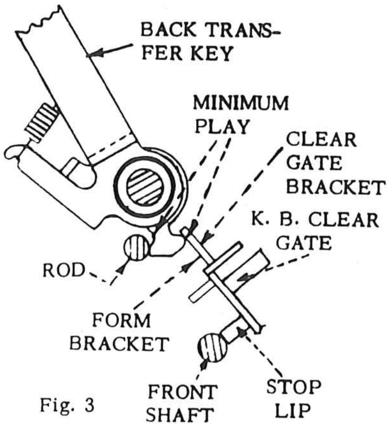


Fig. 3

✓ FIG. 3 - KEYBOARD CLEAR GATE (Back Transfer Key)

When the stop lip is resting on the front shaft as shown, the back transfer key is to have minimum play between the clear gate bracket and the "rod". To adjust, form the clear gate bracket but not so much that there is clearance between the stop lip and the front shaft. Note: On early model SBT machines there is to be minimum side play in the key.

Continued On Next Page

ADJ. 2 - KEYBOARD CLEAR

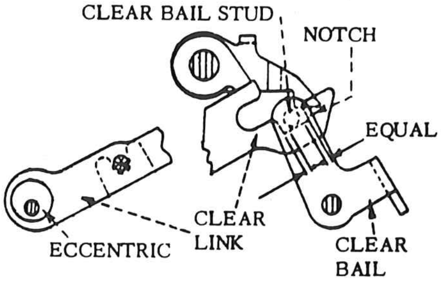
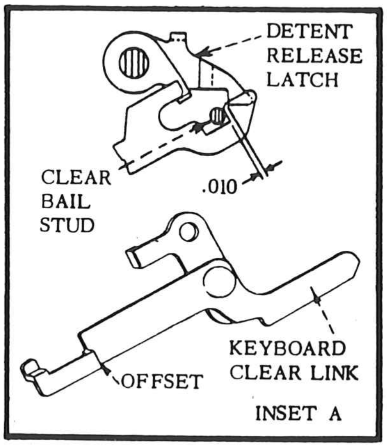


Fig. 4



INSET A

FIG. 4 - RESTORE OF AUXILIARY SLIDES

(Back Transfer Models)

(1) With the clear link all the way rearward, there is to be approximately equal clearance between the notch and the clear bail stud. To adjust, raise the detent release latch to position the clear link rearward; then rotate the eccentric as required.

(2) With the Add Key forward, cycle the machine in "Plus" until the clear link is at its maximum forward travel. The clear bail stud is to overlatch the detent release latch by .010" as shown in the Inset A. To adjust, form the keyboard clear link at the offset. Check to see that the clear bail does not bottom.

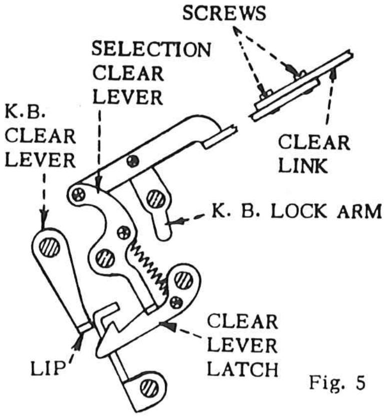
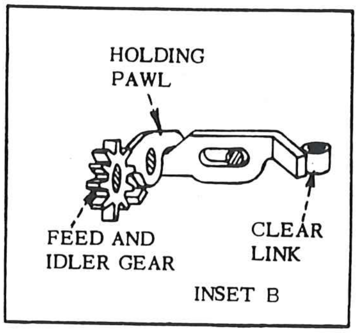


Fig. 5



INSET B

FIG. 5 - RESTORE OF AUXILIARY SLIDES

(Sq. Root Models)

When the keyboard clear key is depressed (selection clear lever latched on the clear lever latch as shown in Fig. 5), the holding pawls are to be disengaged from the feed and idler gears as shown in Inset B. To adjust, loosen the two screws and move the clear link.

To check for positive disengagement, manually move each auxiliary slide forward and then let it restore slowly. If it does not fully restore, it is an indication that its respective holding pawl has not completely disengaged from the feed and idler gear. Readjust the clear link.

Note: If during square root the clear lever latch fails to delatch after keyboard clear, form Lip.

ADJ. 3 - KEYBOARD LOCK

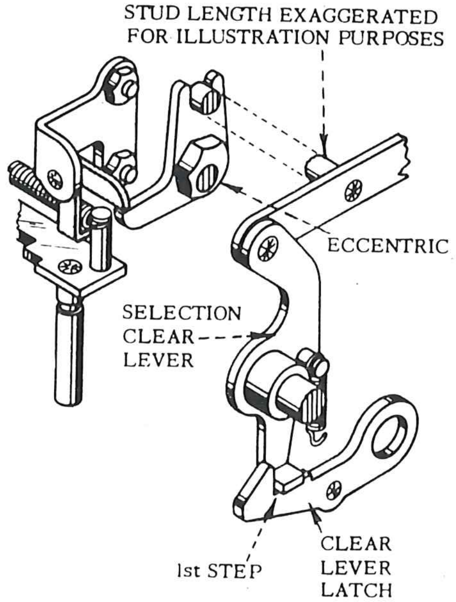
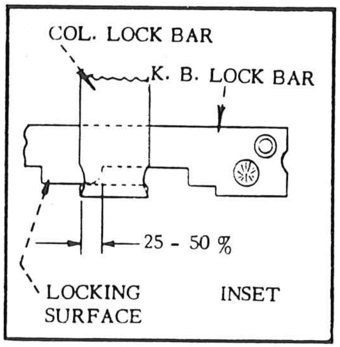


Fig. 1

FIG. 1 - KEYBOARD LOCK

(Revised Sq. Root Models)

With the lip of the selection clear lever positioned on the first step of the clear lever latch, the column lock bars (Inset) are to engage the keyboard lock bar locking surface with a 25% to ~~50%~~ bite. To adjust, release the clear lever latch and rotate the eccentric as required.



Note: No standard adjustment is provided on Sq. root models prior to Serial #883251, nor on other model calculators. However, the 25% to 50% bite should be checked on all machines. Normally the engagement will be within the specified limits, but if not form the keyboard lock arm Adj. 2, Fig. 5 as required.

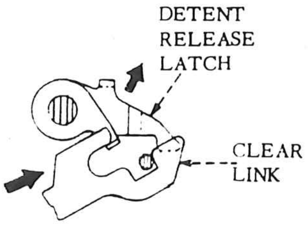


Fig. 2

FIG. 2 - KEYBOARD LOCK (Back Transfer Models)

With the detent release latch delatched the column lock bars (Inset) are to engage the keyboard lock bar locking surface with a 25% to 50% bite. To adjust, raise the detent release latch to position the clear link rearward and rotate the eccentric (shown in Fig. 1) as required.

CARRIAGE SHIFT

ADJ. 1 - SHIFT DRIVE GEAR TIMING

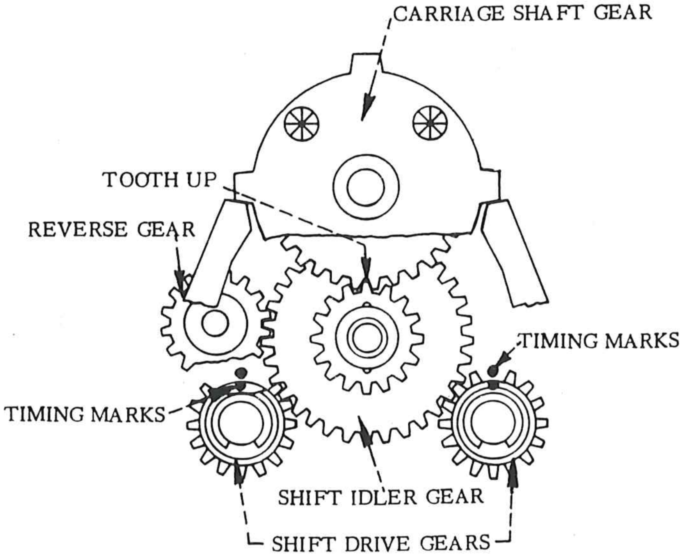


FIG. 1 - SMOOTH SHIFT AND 4-POINT SHIFT

When the timing marks on the shift drive gears and the rear bearing plate are aligned, and the reverse gear is in place; install the shift idler gear with a tooth of its small gear up. Next, install the carriage shift gear with its lugs parallel to the top of the bearing plate. The old style 4 point shift is timed in the same manner.

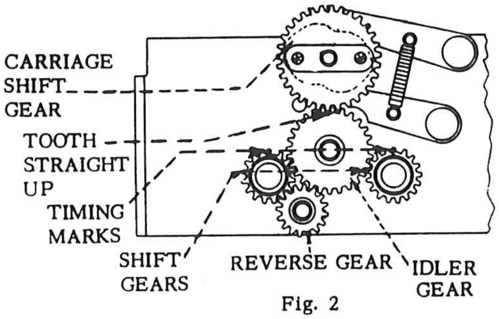


Fig. 2

FIG. 2 - TWO - POINT SHIFT

With the drive shaft in home position, install the reverse gear, the idler gear, and the carriage shift gear (no timing on these gears). Then with the carriage shift gear centralized, install the right and left shift drive gears with their timing marks aligned with the timing marks on the rear bearing plate.

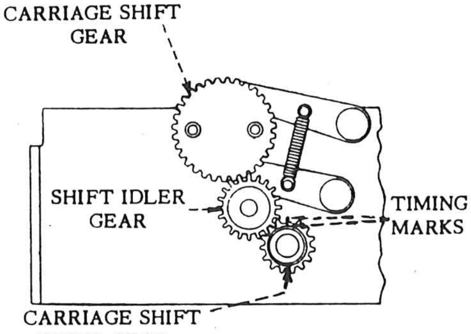


Fig. 3

FIG. 3 - HAND MODELS

With the drive shaft in home position, install the carriage shift gear and the shift idler gear. Then with the carriage shift gear centralized, install the shift drive gear with its timing mark aligned with the timing mark on the bearing plate.

CARRIAGE SHIFT

ADJ. 2 - SHIFT GEAR CENTRALIZING AND UNLOCKING (Smooth Shift Models)

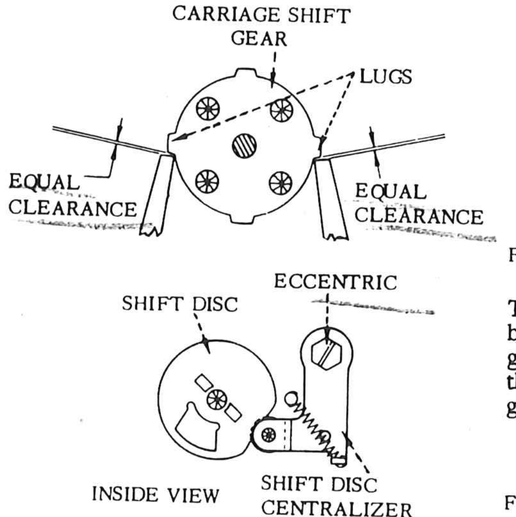


Fig. 1

FIG. 1 - SHIFT DISC CENTRALIZER

There is to be approximately equal clearance between the shift locks and the carriage shift gear lugs. To adjust, turn the eccentric on the shift disc centralizer. Then rotate the shift gear and check the clearance under each lug.

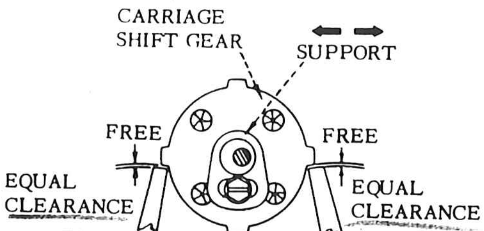


Fig. 2

FIG. 2 - ADJUSTABLE SUPPORT

The shift locks are to be free to move in and out under the shift gear lugs with minimum clearance. To adjust, raise or lower the shift gear by rotating the support. Note: The support must be properly seated on the bearing plate, otherwise the adjustment will have no effect.

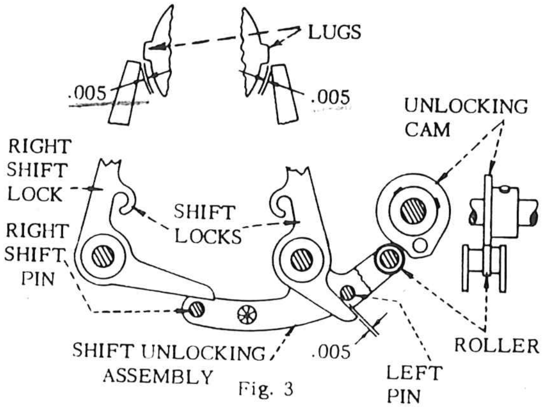


Fig. 3

FIG. 3 - UNLOCKING CAM

(1) In a shift operation, the shift locks are to clear the shift gear lugs with no more than .005" clearance just as the lugs pass the locks. (2) When the left shift key is depressed, the left pin (left shift unlocking pin) is to move over the tail of the left shift lock with approximately .005" minimum clearance.

To adjust, position the unlocking cam on the large roller of the shift unlocking assembly and retard or advance the cam as required. Note: Should the shift unlocking assembly bottom at its limit of travel, or if there is insufficient clearance for the left pin to pass the tail of the left shift lock, move the unlocking cam so it contacts the smaller diameter roller on the shift unlocking assembly.

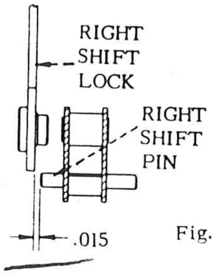


Fig. 4

FIG. 4 - RIGHT SHIFT LOCK

To insure a right shift in multiplication, there is to be .015" clearance between the right shift lock and the end of the right shift pin. To adjust, form the right shift lock.

Continued On Next Page

ADJ. 2 - SHIFT GEAR CENTRALIZING AND UNLOCKING (4-Point Shift Models)

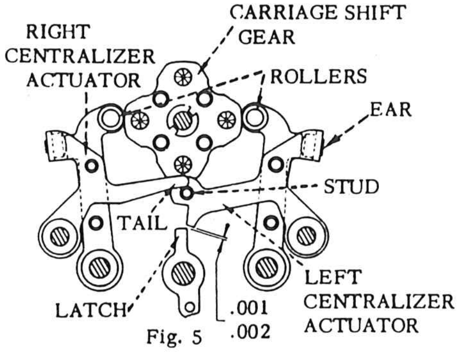


Fig. 5

FIG. 5 - SHIFT GEAR CENTRALIZERS

With the carriage shift gear rotated so the roller on the centralizer arms are on the high lobe of the shift gear, there is to be .001" to .002" clearance between the left centralizer and the latch. To adjust, form the ear of the left centralizer actuator. Also form the ear of the right centralizer actuator so its tail is not raised by the stud of the left actuator.

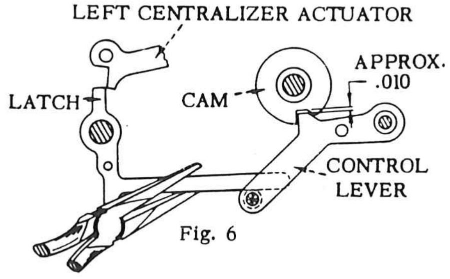


Fig. 6

FIG. 6 - SHIFT CENTRALIZER CONTROL LEVERS

When either shift key is released slowly until the latch releases the left centralizer actuator, the control lever is to be approximately .010" from bottoming in the cam. To adjust, form the tail of the latch.

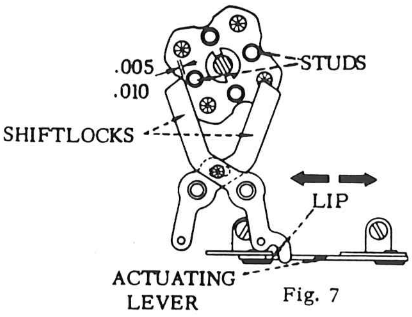


Fig. 7

FIG. 7 - SHIFT LOCKS

The shift locks are to clear the studs on the carriage shift gear by .005" to .010" in both shifts. To adjust, form the lip on the actuating lever.

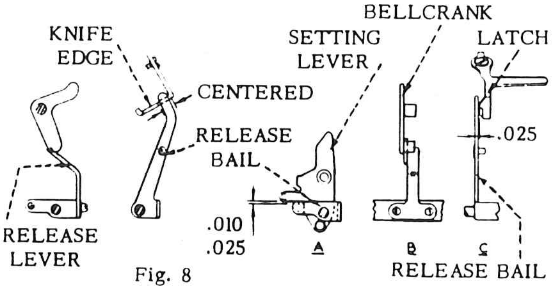


Fig. 8

FIG. 8 - LATCH RELEASE BAILS

(1) With the shift gear half turned, the upper end of the release bail is to be centered between the knife edge of the latch and the rear of the latch. To adjust, form the release lever.

(2) With the machine in home position, the release bail (8c) is to clear the knife edge of the latch by .025". To adjust, position the release lever against the setting lever (8a), and move the release bail. Then position the release lever against the bellcrank (8b), and remove the end play from the assembly, yet have it free.

(3) The stud on the release bail is to clear the setting lever approximately .010" to .025". To adjust, twist the release bail.

Continued On Next Page

CARRIAGE SHIFT

ADJ. 2 - SHIFT GEAR CENTRALIZING AND UNLOCKING (4-Point Shift Models)

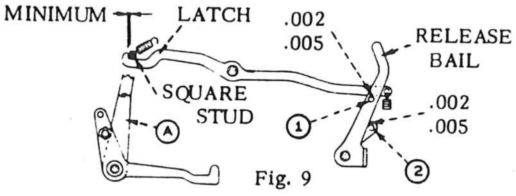


Fig. 9

FIG. 9 - AUTOMATIC CARRIAGE SHIFT CONTROL

(1) Select several zeros in the mult unit, depress the multiplier key and rotate the drive shaft by hand until the carriage is in a half shift. The square stud is to overlatch with minimum clearance to the latch. To adjust, twist arm "A".

(2) While the carriage is still in a half shift, the rear of the latch is to clear stud 1 by .002" to .005". To adjust, form the latch up or down. Then form the bail for .002" to .005" clearance between stud 2 and the release bail.

ADJ. 3 - SHIFT ENGAGING AND DISENGAGING

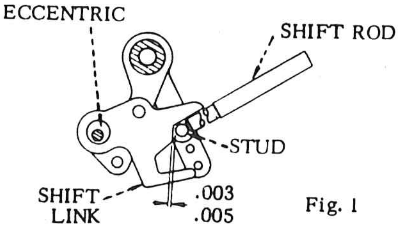


Fig. 1

FIG. 1 - SHIFT ENGAGING LINKS

With the machine in home position there is to be .003" to .005" clearance between the shift link and the stud. To adjust, turn the eccentric as required. Adjust the other shift link in the same manner.

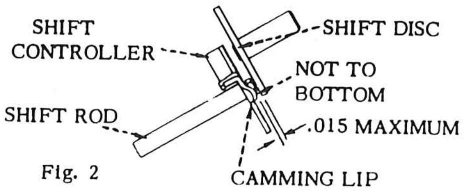


Fig. 2

FIG. 2 - SHIFT CONTROL CLEARANCE TO DISC (Smooth Shift)

With the left shift key held fully depressed, the camming lip on the shift controller is to clear the shift disc by .015" maximum. To adjust, form the camming lip. Adjust the right shift controller the same way.

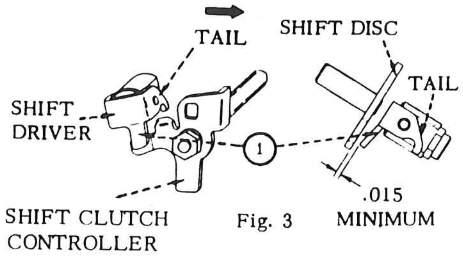


Fig. 3

FIG. 3 - SHIFT DRIVER DISENGAGING (Carriage Clear & Smooth Shift)

With the machine in home position, manually raise the shift clutch controller to engage the shift driver into the shift disc; then allow the shift clutch controller to restore. Next, release the clutch and rotate the drive shaft by hand. Point 1 on the shift driver is to disengage from the shift disc and have .015" clearance from the shift disc. To adjust, form the tail of the shift driver outward. Test each shift driver.

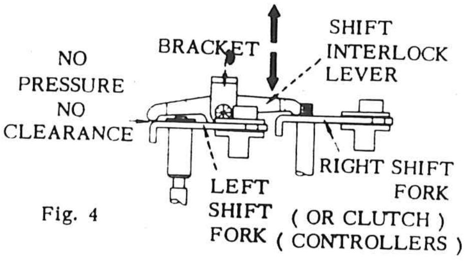


Fig. 4

FIG. 4 - SHIFT INTERLOCK

With a shift key held depressed and the drive shaft half cycled, there is to be no pressure and no clearance to the right and left shift controllers, or (old style shift forks). To adjust, form the interlock bracket in or out as required.

Continued On Next Page

CARRIAGE SHIFT

ADJ. 3 - SHIFT ENGAGING AND DISENGAGING

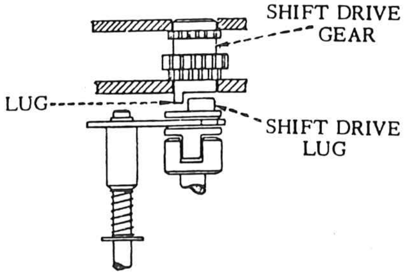
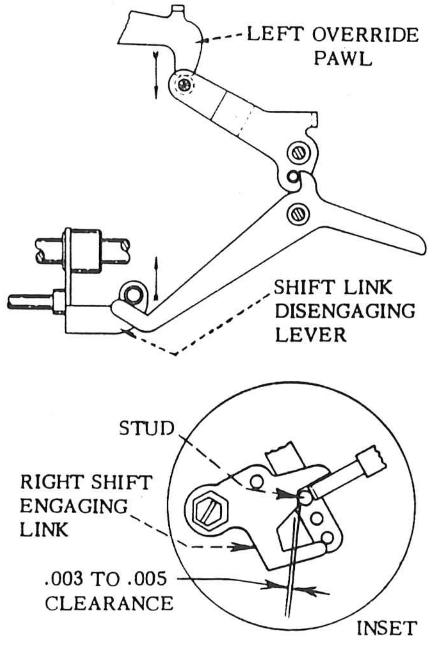


Fig. 5

FIG. 5 - ENGAGEMENT OF SHIFT DRIVE LUG (2& 4 Point Shift)

On two and four point shift models, the shift drive lug is to have a good engagement with the lug on the shift drive gear but is not to bottom. To adjust, turn the eccentric on the shift link (Fig. 1) as required.

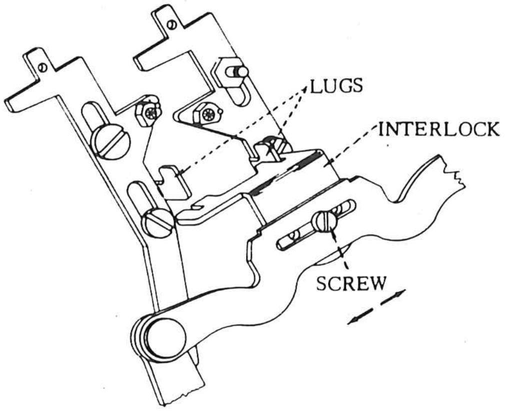
ADJ. 4 - RIGHT SHIFT DISABLING LEVER



When the carriage is shifted to the extreme right, and the right shift key is held down, the carriage shift gear is to disengage on the first override action. To adjust, form the shift link disengaging lever up or down.

In home position the right shift engaging link is to drop freely over its stud with .003" to .005" clearance (per Inset).

ADJ. 5 - SHIFT KEY INTERLOCK



When either shift key is depressed, its Lug is to move freely into the interlock slot without touching. To adjust, move the interlock, or if necessary, form the Lugs to obtain the needed alignment.

CARRIAGE SHIFT

ADJ. 6 - SHIFT HANDLE CENTRALIZER (Hand Models)

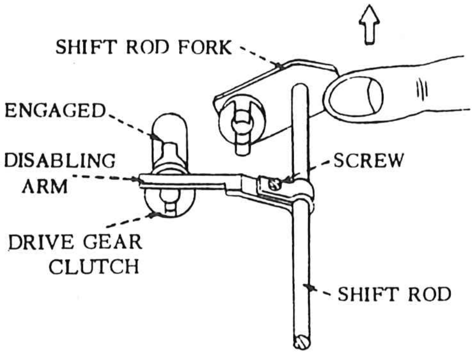


Fig. 1

FIG. 1 - DISABLING ARM FOR SHIFT DRIVE CLUTCH

Loosen the screw on the disabling arm. With one finger holding the shift rod fork to the rear of the machine, push the disabling arm to the rear of the machine until it positions the drive gear clutch into engagement with the shift drive gear assembly. Tighten the screw.

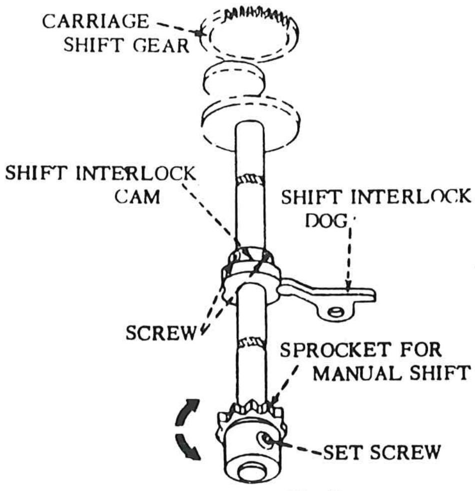


Fig. 2

FIG. 2 - SPROCKET FOR MANUAL SHIFT

(1) There is to be an equal amount of movement of the shift handle in both directions before the carriage shift gear begins to move. If not, loosen the set screw and rotate the sprocket.

(2) With the shift handle centralized, the shift interlock dog is positioned in the notch of the shift interlock cam by loosening the set screws.

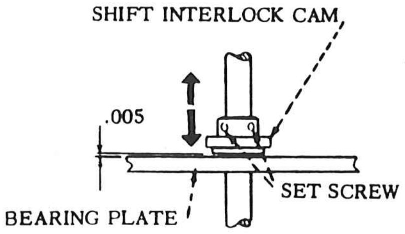


Fig. 3

FIG. 3 - SHIFT INTERLOCK CAM

There is to be .005" clearance between the shift interlock cam and the center bearing plate. To adjust, move the interlock cam. (Recheck step 2 of Fig. 2.)

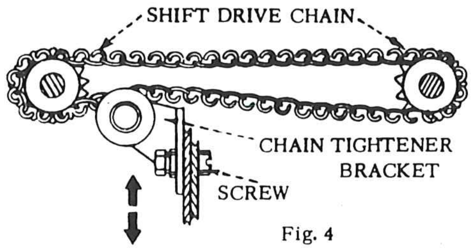


Fig. 4

FIG. 4 - CHAIN TENSION

To adjust the chain tension, loosen the screw and move the chain tightener bracket up for more tension, or down for less tension. Tighten screw.

ADJ. 1 - CLUTCH RELEASE

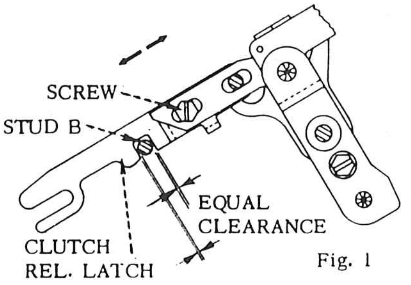


Fig. 1

FIG. 1 - CLUTCH RELEASE LATCH ENGAGEMENT
(Except Power Set Gate Models)

With the drive shaft in home position the clutch release latch is to have equal clearance on each side of the stud. To adjust, move the latch. Check by lifting the latch and allowing it to restore on the stud.

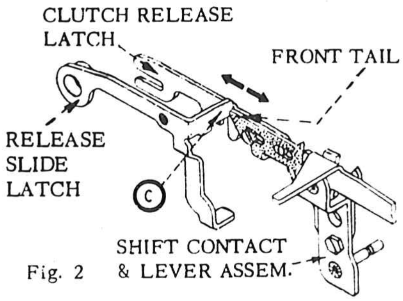


Fig. 2

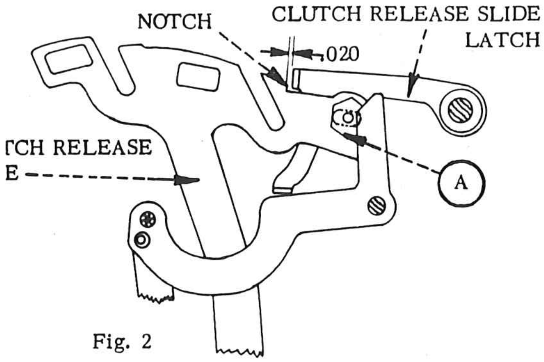
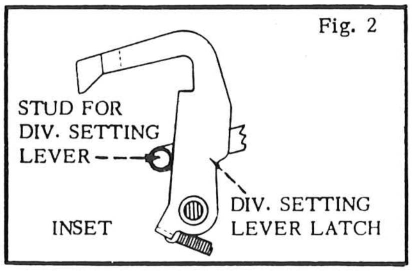


Fig. 2

FIG. 2 - CLUTCH RELEASE SLIDE LATCH ENGAGEMENT

With the add-key forward and the machine running in division, the front tail on the shift contact and levers assembly is to engage lip "C" on the release slide latch. Also, there is to be no bounce on the front tail while running in division. To adjust, form lip "C".

With the division setting lever delatched as shown in the Inset, there is to be .020" clearance between the clutch release slide latch and the edge of the notch on the clutch release slide. To adjust, move stud A.



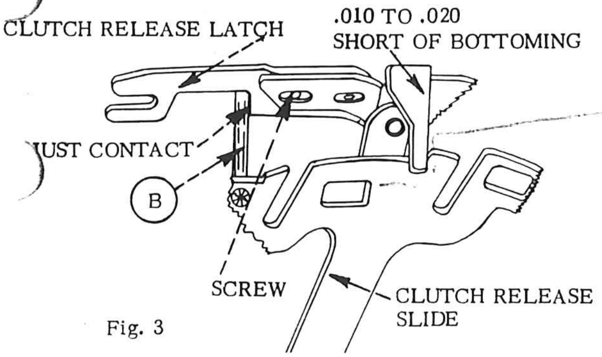


Fig. 3

FIG. 3 - CLUTCH RELEASE LATCH

With the division setting lever delatched as shown in the Inset, the clutch release latch is to just contact stud B. To adjust, move the clutch release latch forward or rearward as required.

Note: After adjusting as above, check to see that the lip on the clutch release latch is approximately .010" to .020" short of bottoming against the frame.

ADJ. 2 - CLUTCH RELEASING AND POWER SHIFT

Because so many factors effect clutch releasing and power shift, this adjustment has been arranged in seventeen steps that must be followed in the sequence as outlined.

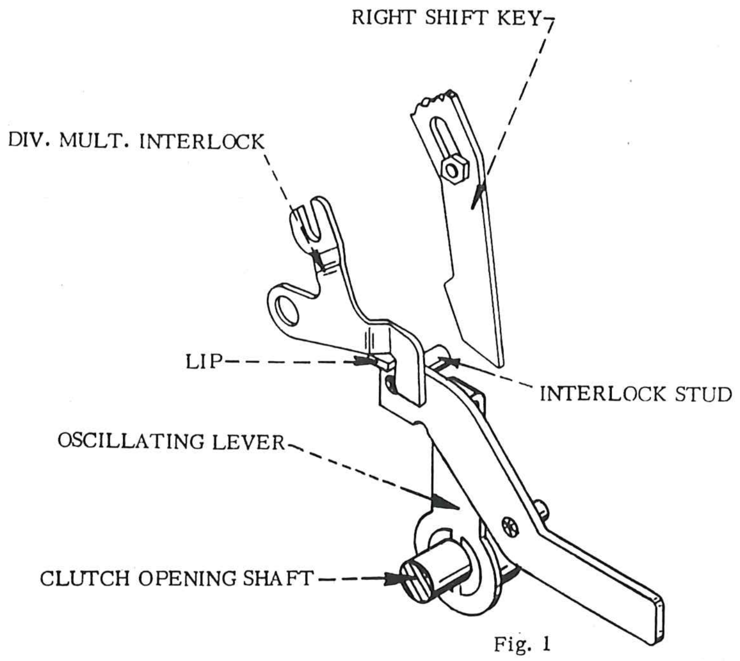


FIG. 1 - HOME POSITION OF THE CLUTCH OPENING SHAFT

IMPORTANT! All of the following adjustment steps are dependent on the clutch opening shaft being in its home position. This is a MUST! Failure to check this home position after each adjustment step will result in having the machine improperly adjusted.

The home position of the clutch opening shaft can be checked as follows:

1. The division-mult interlock is to be free to rotate in and out of position behind the lip on the oscillating lever without catching or dragging on the lip.
2. Cycle the machine with the right shift key depressed and see that the key restores without catching or dragging on the interlock stud.

If it is found that the clutch opening shaft is not in its home position, check to find the cause for the restriction before continuing with the adjustments.

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ADJ. 2 - CLUTCH RELEASING AND POWER SHIFT

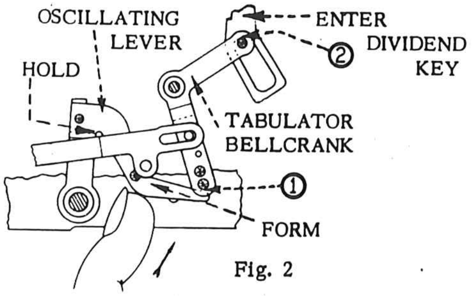


Fig. 2

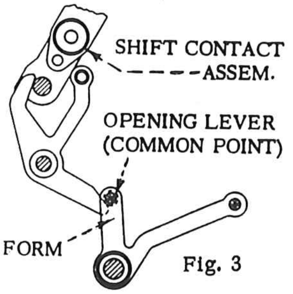
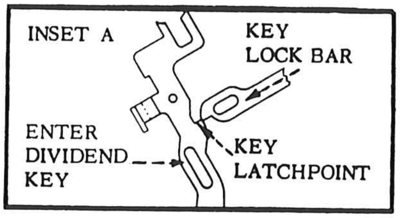


Fig. 3



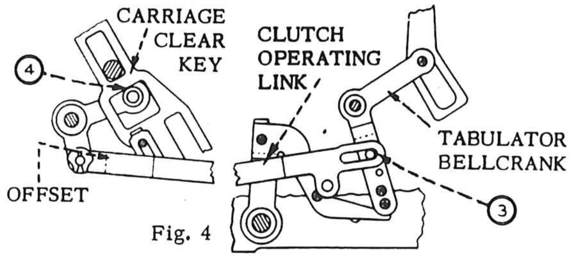
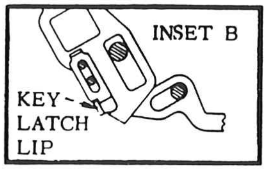


Fig. 4



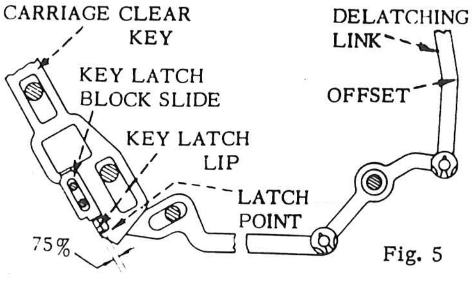


Fig. 5

FORM TAB BELLCRANK

FIG. 2 - TABULATOR BELLCRANK

With light pressure against the oscillating lever, there is to be minimum movement at points 1 and 2 on the tabulator bellcrank. To adjust, [redacted] at point shown. To check, depress the mult key. The enter dividend key is to be interlocked by the tabulator bellcrank interlock. Note: The oscillating lever must be blocked before attempting to form it.

FIG. 3 - CLUTCH RELEASE (Enter Dividend Key)

On a slow depression of the enter dividend key, the clutch is to release just as the keylock bar latches on the dividend key latch point as shown in Inset A. To adjust, form at common point as shown.

FIG. 4 - CLUTCH RELEASE (Carriage Clear)

On a slow depression of the carriage clear key, the clutch is to release just as the keylatch lip (inset B) moves into place. To adjust, form the clutch operating link at the offset. Then check to see that the parts are free and that there is a slight movement in the clutch operating link at points 3 and 4.

FIG. 5 - CARRIAGE CLEAR KEY LATCH

When the carriage clear key is depressed there is to be a 75% engagement of the key latch lip on the latch point of the carriage clear key. If the carriage clear key is held depressed, the key latch block slide is to remain on top of the key latch lip until the clear action is completed. Then the keylatch block slide must drop behind the keylatch lip as shown in Inset B. Also, while the division stop lever is held to the rear, the key latch lip is to clear the carriage clear key. To adjust, form the delatching link at the offset.

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ADJ. 2 - CLUTCH RELEASING AND POWER SHIFT

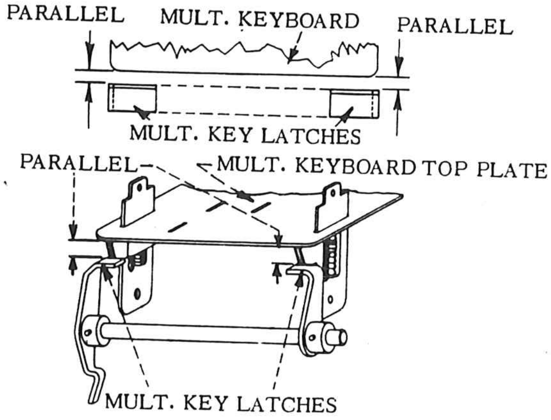

Fig. 6

FIG. 6 - MULT KEY LATCHES

The latch lip on the mult key latches are to be parallel to the mult keyboard top plate and aligned with each other so they have equal engagement with the mult keys. To adjust, form the latch lips as required. Note: Once the latches are properly adjusted, do not change them as this will effect the latching point for the clutch release.

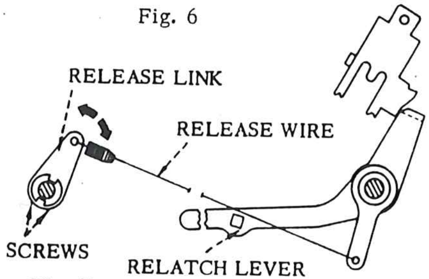

Fig. 7

FIG. 7 - MULTIPLIER KEY RELEASE

When the multiplier unit is escaped one or more positions, the release wire is to be taut, but is not to raise the relatch lever. To adjust, move the release link.

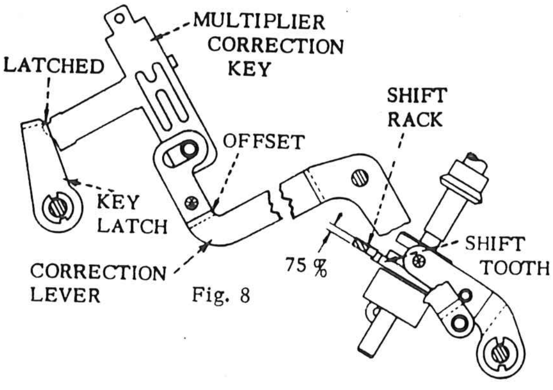

Fig. 8

FIG. 8 - SHIFT TOOTH ENGAGEMENT

When the mult correction key is latched, the shift tooth is to engage the shift rack by approximately 75%. To adjust, form the correction lever at the offset.

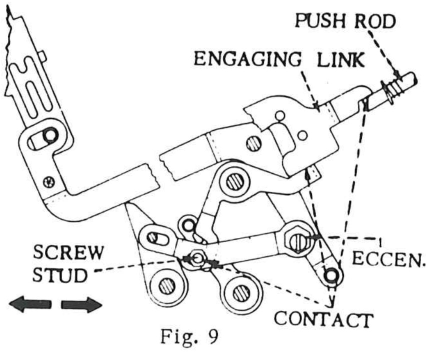

Fig. 9

FIG. 9 - CLUTCH RELEASE

(Multiplier Correction)

(1) The clutch is to release just as the keylatch slips over the key latch point on the multiplier correction key. To adjust, rotate the eccentric.

(2) With the machine in home position, the engaging link is to be positioned at the three points of contact as shown. To adjust, move the screw stud.

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ADJ. 2 - CLUTCH RELEASING AND POWER SHIFT

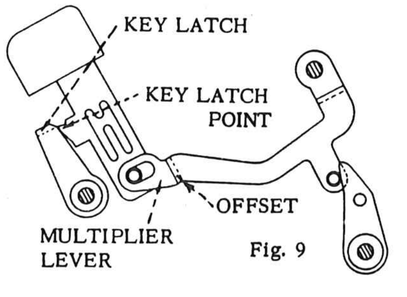

Fig. 9

FIG. 10-CLUTCH RELEASE (Multiply Key)

On a slow depression of the multiply key, the clutch is to release just as the key-latch slips over the key latch point. To adjust, form the multiplier lever at the offset.

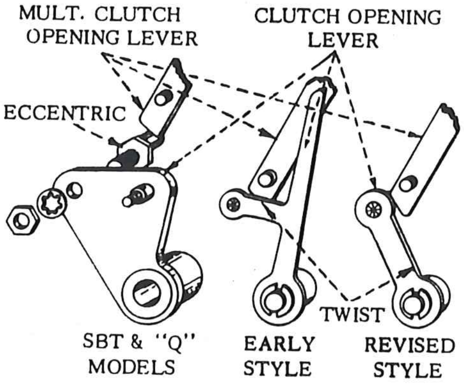

Fig. 10

FIG. 11 - CLUTCH RELEASE (Accum. Mult. Key)

On a slow depression of the accum. mult key, the clutch is to release just as the key latch slips over the key latch point. To adjust early and revised styles twist the clutch opening lever at point indicated. SBT and "Q" models, rotate the eccentric.

Note: No clutch release adjustment is required for the negative multiply key. It will operate properly even though its clutch release is slightly off in relation to the accum. mult. key.

FIG. 12- POWER SHIFT - INITIAL POSITIONING OF OSCILLATOR LEVER

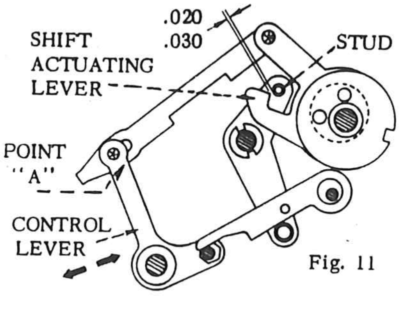

Fig. 11

With the drive shaft slowly rotated until the shift actuating lever is at its closest point to the stud, there is to be .020" to .030" clearance between the stud and the edge of the shift actuating lever. To adjust, release the clutch without depressing a key. Rotate the drive shaft until the shift actuating lever is positioned at its closest point to the stud. Then form the control lever at point "A" as required.

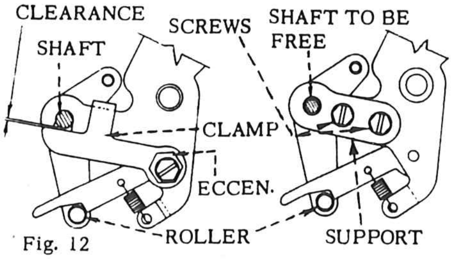

Fig. 12

FIG. 13 - AUTO CLEAR LEVER SHAFT

The auto clear lever shaft is to be free to rotate. To adjust models with clamp, turn the eccentric. To adjust models with support, loosen the screws and move the support until the shaft is free.

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ADJ. 2 - CLUTCH RELEASING AND POWER SHIFT

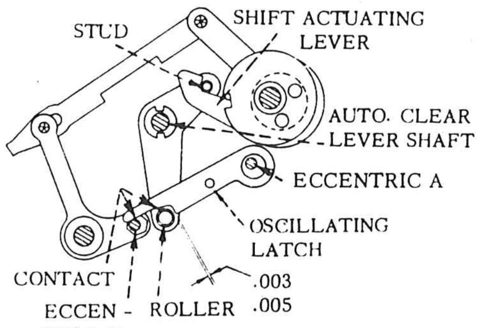


Fig. 14

FIG. 14 - OSCILLATOR LEVER

With the enter dividend key depressed and the drive shaft rotated slowly to bring the shift actuating lever to its high point of movement, there is to be .003" to .005" clearance between the oscillating latch and the roller. To adjust, rotate eccentric A. Also the latch is to rest on the roller and eccentric B. Adjust eccentric B.

Note: When the shift actuating lever is at its high point of movement, check to see that the auto clear lever shaft is not bowed due to the engaging links being bottomed.

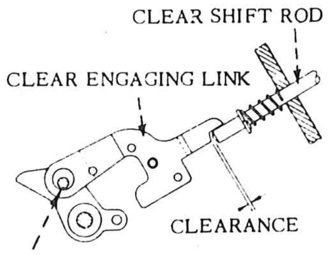
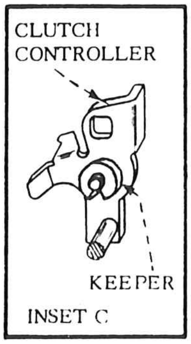


Fig. 15



INSET C

FIG. 15 - CLEAR SHIFT ROD ENGAGING LINK

(1) With the machine in home position, the clear engaging link is to have clearance to the end of the clear engaging shift rod.

(2) With the clear shift rod actuated rearward by the clear engaging link, the clutch controller is to be fully positioned to the rear; but the keeper on the end of the shift rod is not to move away from the clutch controller (inset C).

To adjust, rotate the eccentric.

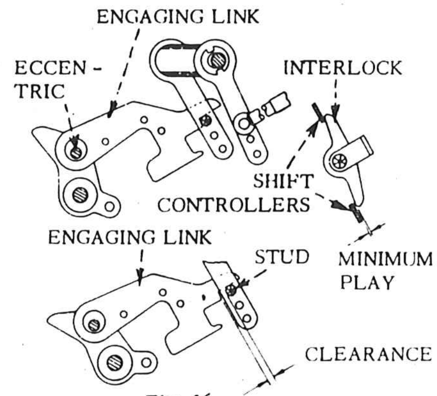


Fig. 16

FIG. 16 - SHIFT ENGAGING LINK AND INTERLOCK

(1) With the machine in home position, the shift engaging link is to have clearance to the end of the shift rod.

(2) With the left shift rod actuated to its maximum rearward movement by the engaging link, there is to be minimum play between the shift controllers and the interlock.

To adjust, rotate the eccentric.

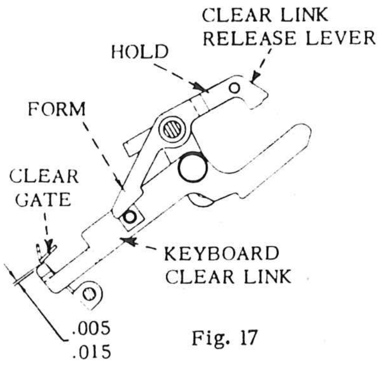
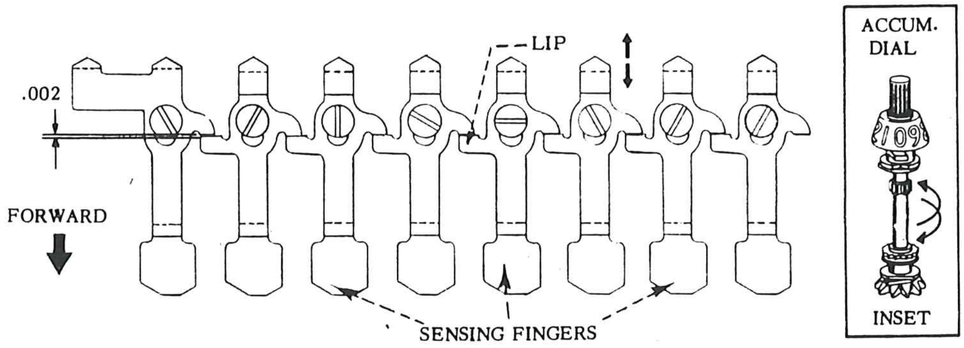


Fig. 17

FIG. 17 - KEYBOARD CLEAR LINK

Check the clearance of the keyboard clear link to the clear gate. With the add-key down, cycle the drive shaft by hand in these operations: Multiplication, enter dividend, carriage clear. The clear link is to move under the clear gate by .005" to .015" on the operating keys that depress the clear link the least. To adjust, form the clear link release lever at point indicated.

ADJ. 1 - SENSING FINGER CLEARANCE TO DIAL CAMS



(1) With the last sensing finger on the left held forward, there is to be no front to rear movement in any of the sensing fingers to the right.

(2) With a number in the 19th dial, there is to be .002" movement in all the sensing fingers.

(3) With numbers in all the dials over the sensing fingers, there is to be .002" movement between the sensing fingers and their respective sensing cams on the accumulator dials.

To adjust, form the lips on the sensing fingers as required. Check to see that the sensing fingers are riding the periphery of the sensing cams and that the dials rotate FREELY and DETENT properly.

ADJ. 2 - CARRIAGE ALIGNMENT

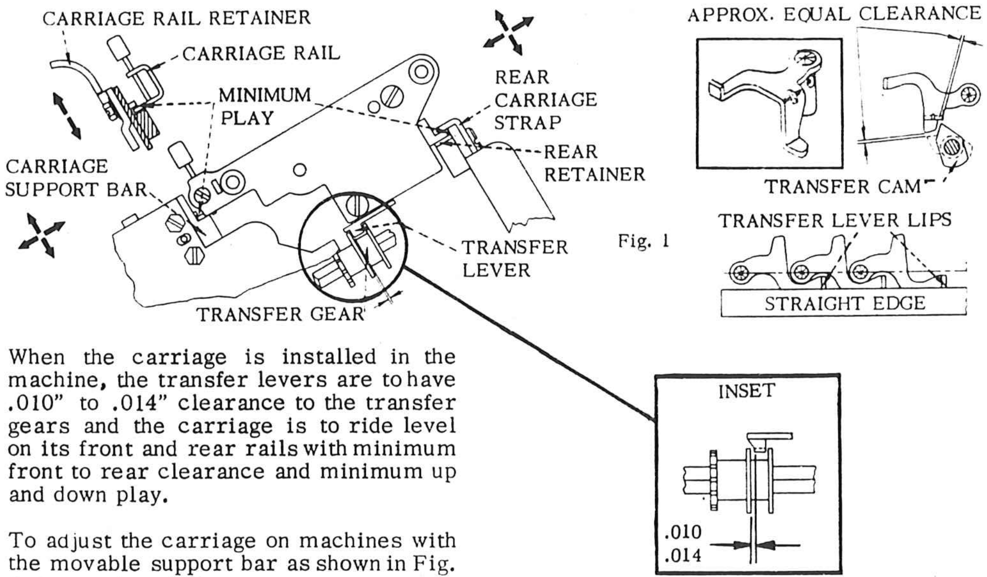


Fig. 1

When the carriage is installed in the machine, the transfer levers are to have .010" to .014" clearance to the transfer gears and the carriage is to ride level on its front and rear rails with minimum front to rear clearance and minimum up and down play.

To adjust the carriage on machines with the movable support bar as shown in Fig. 1, proceed as follows:

(1) Loosen the rear carriage straps and the carriage front rail retainers.

(2) Move the carriage support bar forward or rearward to obtain the .010" to .014" transfer lever clearance to the transfer gears. But before tightening the screws, raise or lower the left end of the carriage support bar to level the carriage.

(3) Next, lower the carriage front rail retainers for minimum up and down play.

NOTE: Before installing the carriage check the transfer levers with a straight edge (see Inset) and form the levers as required. Also on fractional cent carriages, check to see that the fractional cent transfer levers (Inset) have approximately equal clearance on both sides of the transfer cam. To adjust remove the transfer levers and form the upper tail as required.

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CARRIAGE

ADJ. 2 - CARRIAGE ALIGNMENT

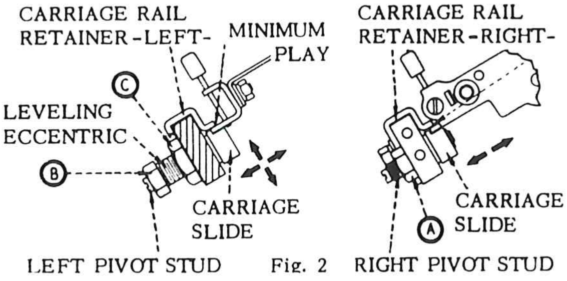


Fig. 2

FIG. 2 - RIGHT & LEFT PIVOT STUDS

To adjust the carriage on machines having the adjustable screw studs, proceed as follows:

(1) Loosen the rear carriage straps and the carriage front rail retainers.

(2) Level the carriage by means of the leveling eccentric. Then turn the right and left pivot studs to move the carriage forward or rearward until the transfer levers have .010" to .014" clearance.

(3) Next, lower the carriage front rail retainers for minimum up and down play.

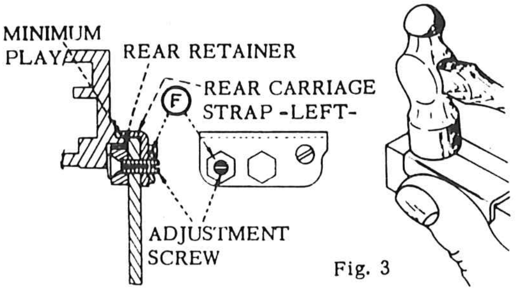


Fig. 3

FIG. 3 - REAR RETAINER

The rear carriage straps (either old or new type) must be adjusted for minimum front to rear play and yet the carriage must be free.

For new style carriage straps, loosen Nut F and turn the adjustment screw in or out as required. Then form the straps up or down to obtain minimum up and down play.

For old style carriage straps, remove the straps and peen with a hammer to lengthen (as shown). Install the straps and check the movement as explained above. If the straps are too tight, or burred, file the edge as required. It may be necessary to form the straps up or down to obtain minimum up and down play.

ADJ. 3 - BELL

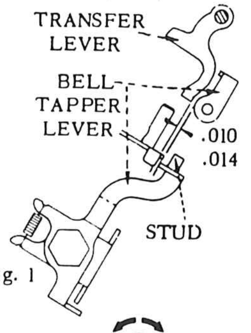


Fig. 1

FIG. 1 - TRANSFER LEVER CLEARANCE

On machines equipped with a bell, the bell should ring on an overdraft, or on an overdraft correction. It should not ring in division, nor when an overdraft occurs when a "9" is in the 20th dial and the carriage is in the 7th position.

With the machine in home position, there should be .010" to .014" clearance between the bell tapper lever and the transfer lever. To adjust, form the bell tapper lever but keep the stud straight.

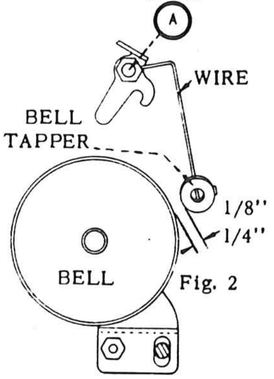


Fig. 2

FIG. 2 - BELL TAPPER CLEARANCE TO BELL

The bell tapper should have approximately 1/8" to 1/4" clearance to the bell. To adjust, move the bell tapper at screw A. Test as stated above. To obtain the best operation it may be necessary to readjust screw A; form the bell tapper wire; or move the bell.

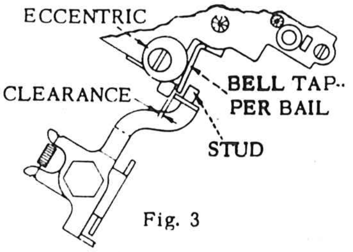


Fig. 3

FIG. 3 - OVERDRAFT WITH CARRIAGE IN 7th POSITION

With a "9" in the 20th dial and the carriage in the 7th position, check to see that the bell does not ring. If it does ring, adjust the eccentric for clearance to the transfer levers, but maintain clearance to the stud as shown.

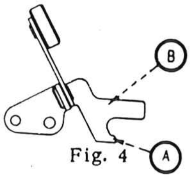


Fig. 4

FIG. 4 - FULL TRANSFER MODELS EQUIPPED WITH BELL

To adjust for proper ringing action when making an overdraft, form the tail A. To adjust the bell not to ring in division, form at tail B.

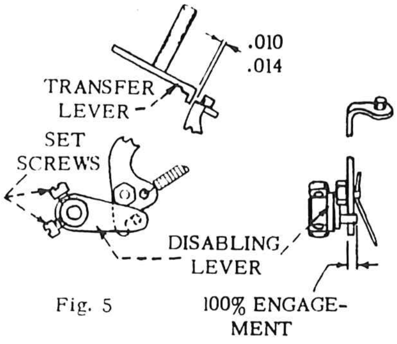


Fig. 5

FIG. 5 - HAND-MODEL MACHINES

(1) With the machine in home position, loosen the set-screws and rotate the disabling lever for .010" to .014" clearance between the bell tapper lever and the transfer lever. (2) While holding the bellcrank lifter shaft to the right, move the disabling lever for 100% engagement to the bell tapper lever.

ADJ. 4 - SPRING TRANSFER

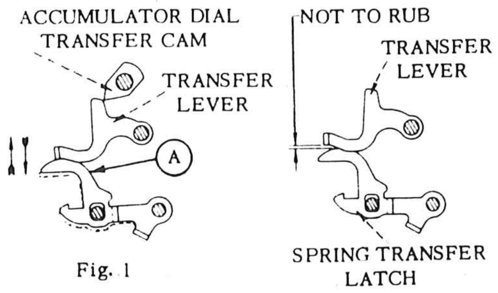


Fig. 1

FIG. 1 - DELATCHING

After the carriage is set for the .010" to .014" transfer lever clearance, test the spring transfer latch as follows: (1) Check to see that the transfer lever does not bottom the spring transfer latch. (2) The transfer lever is to be close enough to delatch the spring transfer latch; but is not to rub the spring transfer latch as the carriage is shifted.

To adjust, manually position an accumulator dial transfer cam as shown; and then test for movement of the spring transfer latch away from the transfer lever. If the latch does not have any movement away from the lever, form at "A". Note: The clearance between the lever and the latch may or may not be the same as the .010" to .014" transfer lever clearance.

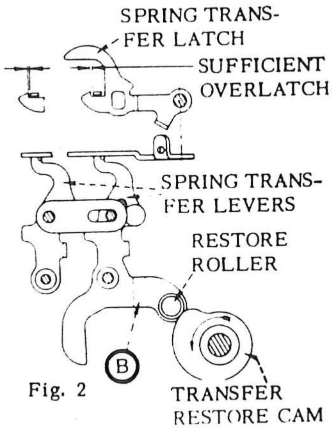


Fig. 2

FIG. 2 - RELATCHING

With both spring transfer latches tripped off, rotate the drive shaft until the transfer restore cam is on the high point of movement with the restore roller. The spring transfer levers are to restore just enough to insure the latching and overthrow of the transfer pawls into the next ratchet tooth space. To adjust, form the lever at "B". The overlatch of the upper ends of the spring transfer levers to the spring transfer latch must be sufficient to insure latching.

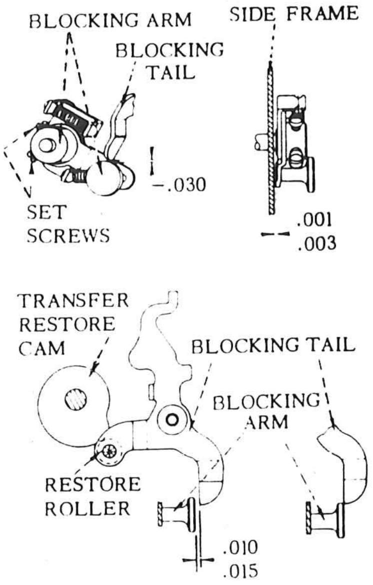


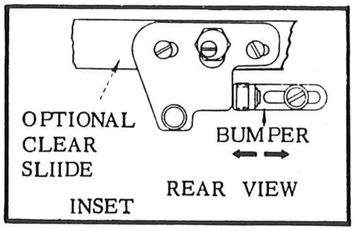
Fig. 3

FIG. 3 - BLOCKING ARM

With the machine in home position the blocking arm is to: (1) Clear the blocking tail by .030", and have .001" to .003" clearance to the side frame. (2) With the transfer restore cam positioned as shown there is to be .010" to .015" clearance between the blocking arm and the blocking tail when the bellcrank lifter shaft is rotated by hand. To adjust for the first condition, loosen the set screws and move the blocking arm as required. To adjust for the second condition, form the blocking tail.

ADJ. 5 - ACCUMULATOR DIAL CLEAR RACKS

For proper operation of the carriage, the following adjustments must be carefully followed in the sequence given for the particular type of carriage being worked on.



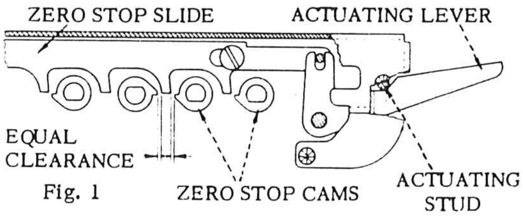
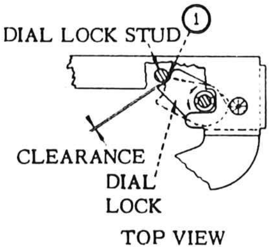


Fig. 1

FIG. 1 - MODELS WITHOUT ZERO STOP SLIDE BUMPER

With the optional clear slide resting against its bumper (Inset) and the actuating stud contacting the zero stop slide actuating lever, the zero stop slide is to have approximately equal clearance to the zero stop cams. To adjust, move the optional clear slide bumper. Check by turning adjacent dials to a "0" and a "5" as shown.

Note: On half-cent and full capacity carriages it is sometimes necessary to have slightly less clearance on the left than on the right.



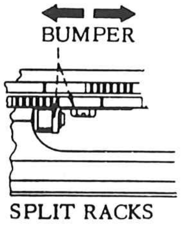


Fig. 2

FIG. 2 - MODELS WITHOUT ZERO STOP SLIDE BUMPER

With the zero stop slide adjusted, the right half accumulator clear rack is to be to the left for a minimum of clearance at Point 1. To adjust, move the bumper on the right accumulator clear rack against the carriage frame.

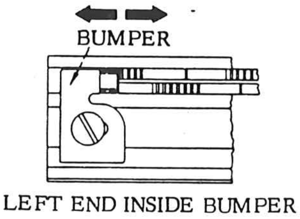


Fig. 3

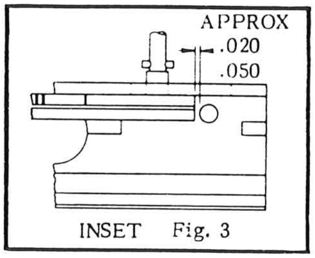


Fig. 3

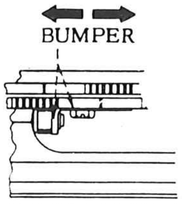


Fig. 3

FIG. 3 - ACCUMULATOR CLEAR RACK (One-piece)

The one-piece accumulator clear rack is to have approximately .020" clearance between the end of the rack and the hole (or interlock slide slot on early model machines) in the right end of the carriage frame as shown in the Inset. To adjust, move the inside bumper at the left end of the carriage. To check the adjustment, insert a rod through the hole and note the clearance felt between the rack and the rod.

ACCUMULATOR CLEAR RACK (Split with Zero Stop Slide Bumper)

For split type accumulator clear racks there is to be approximately .020" clearance between the right and the hole in the carriage frame. To adjust, move the bumper on the right accumulator clear rack against the carriage frame.

ADJ. 5 - ACCUMULATOR DIAL CLEAR RACKS (Cont.)

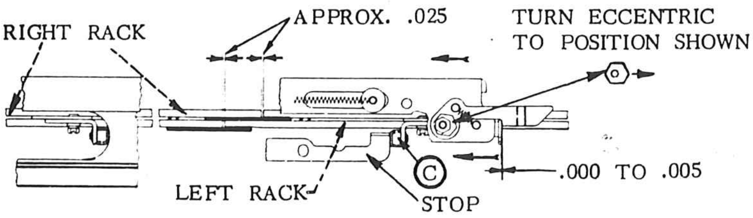


Fig. 4

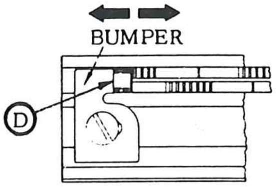


FIG. 4 - CLEARANCE BETWEEN SPLIT CLEAR RACKS

(1) There should be .025" clearance between the right and left accumulator clear racks when the right rack is in home position and the left rack is operated. To adjust, position the upper right optional clear knob (dial lock) to prevent clearing. With bumper C loose, manually hold the right clear rack to the left and move the left clear rack to the right until they touch. Allow the left rack to move back from the right rack .025" and set bumper C against its stop. This adjustment will prevent the racks from colliding should the left rack be operated without the right rack.

(2) Rotate the eccentric on the split clear latch so the high side is positioned as shown. Then adjust the inside bumper "D" to obtain .000" to .005" clearance between the split clear latch and the latch lip.

ADJ. 6 - OPTIONAL CLEAR SLIDE AND ZERO STOP SLIDE

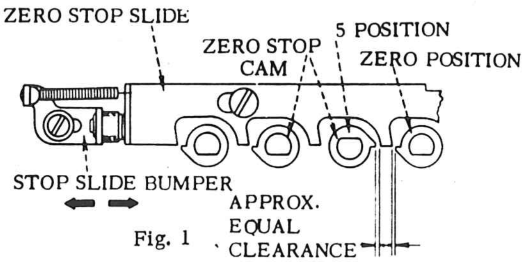


Fig. 1

FIG. 1 - MODELS WITH ZERO STOP SLIDE BUMPER

Turn adjacent dials to a "0" and a "5". Adjust for approximately equal clearance of the stop slide to the zero stop cams by moving the stop slide bumper.

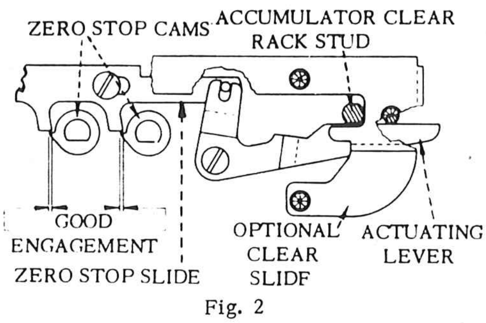
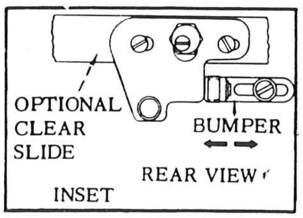


Fig. 2

FIG. 2 - ZERO STOP SLIDE ENGAGEMENT

When the accumulator clear rack stud and the optional clear slide are cleared manually to their maximum throw, the zero stop slide is to have a good engagement with the zero stop cams but must not bottom. To adjust, form the actuating lever.

A good test is to turn any odd numbered dial (1,3,5, etc.) to a number "1" and observe that as the accumulator clear rack is actuated, the stop slide moves into good engagement before the dials turn to zero. If the stop slide does not engage deep enough as the dials turn to zero, the zero stop cams will slip by and a lock-up will occur.



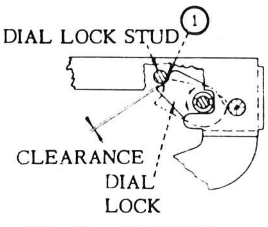


Fig. 3 TOP VIEW

FIG. 3 - MODELS WITH ZERO STOP SLIDE BUMPER

With the optional clear slide resting against its bumper, turn the dial lock in and out. There is to be a slight drag between the dial lock and the dial lock stud at point 1. This will leave a slight clearance between the stud and the dial lock when the dial lock is turned in. To adjust, move the bumper bracket as required (per the Inset).

ADJ. 6 - OPTIONAL CLEAR SLIDE & ZERO STOP SLIDE

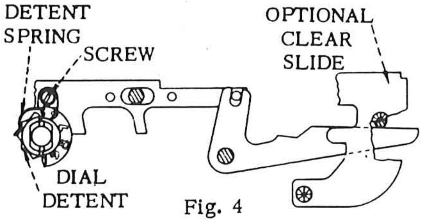


Fig. 4

FIG. 4 - EARLY HALF-CENT CARRIAGES

When the optional clear slide is pulled to the right, the detent spring is to press into the dial detent. When in home position, the detent spring is to clear the dial detent. To adjust, turn the spring as required.

ADJ. 7 - COUNTER CLEAR RACK AND ZERO STOP SLIDE

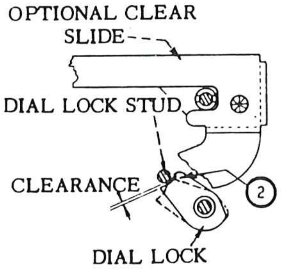
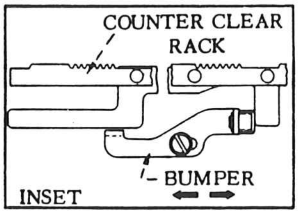
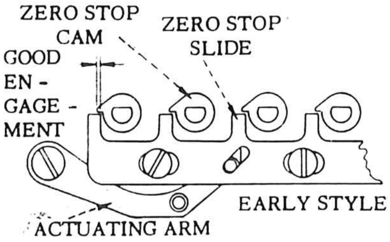


Fig. 1

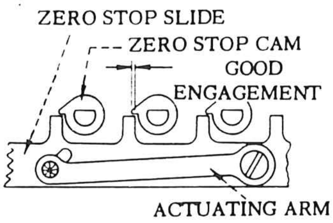
FIG. 1 - COUNTER DIAL LOCK ENGAGEMENT

With the counter clear rack resting against its bumper, turn the dial lock in and out. There is to be a slight drag between the dial lock and the dial lock stud at point 2. This will leave a slight clearance between the stud and the dial lock when the dial lock is turned in. To adjust, move the bumper as shown in the Inset.





EARLY STYLE



REVISED STYLE

Fig. 2

FIG. 2 - COUNTER ZERO STOP SLIDE ENGAGEMENT

When the counter clear rack is moved to the right there is to be a good engagement of the counter zero stop slide to the stop cams on the dials. To adjust, form the actuating arm by twisting it.

ADJ. 8 - ALIGNMENT OF CARRIAGE FOR ADD-SUBTRACT GEAR MESH

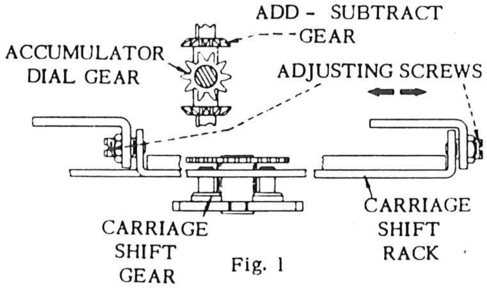


Fig. 1

FIG. 1 - ADD-SUBTRACT GEARS

With the carriage shift rack engaged with the carriage shift gear and the add-subtract gate moved from plus to minus, the accumulator dial gears are to have a minimum of movement. To adjust, loosen the shift rack clamp (Fig. 3), and move the carriage right or left by turning the adjusting screws. Do not bow the shift rack with the adjusting screws, but have a slight drag to shift rack when it is moved up or down.

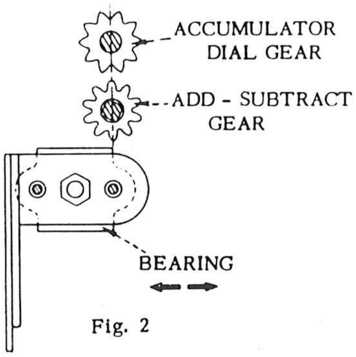


Fig. 2

FIG. 2 - ADJUSTABLE BEARING FOR EXTRA TRANSFER

With the shift rack adjusted as above, check the dial movement over the extra transfer add-subtract gears. Adjust the bearing to the right or left to eliminate any movement in the dials when the add-subtract gate is moved from plus to minus.

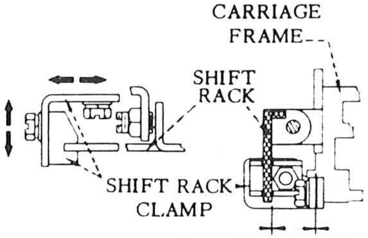


Fig. 3

FIG. 3 - SHIFT RACK

The shift rack is to be parallel to the carriage frame. To adjust, move the shift rack clamp.

ADJ. 9 - ACCUMULATOR DIAL CLEARING

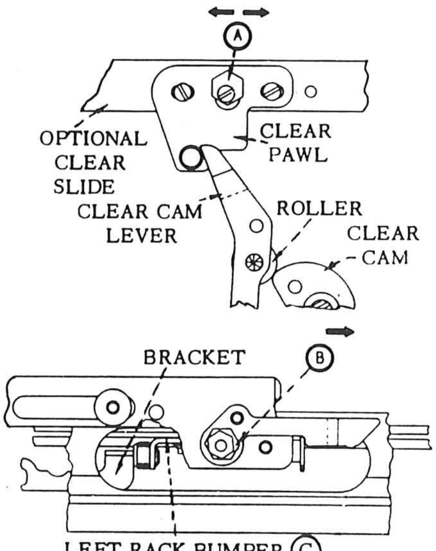


Fig. 1

FIG. 1 - OPTIONAL CLEAR SLIDE

With the right and left accumulator dial clear racks at their maximum travel to the right (clear cam on high point of movement with the clear cam lever), the left rack bumper "C" is to contact the bracket without compressing the bumper (See Note). To adjust, manually position the clear cam against the roller on the clear cam lever as shown; then adjust the eccentric "A" as required.

NOTE: Before making the above adjustment, the eccentric "B" must be adjusted as described in Adj. 5, Fig. 3, this section. After the adjustment is made it should be rechecked and re-adjusted if necessary. Also the bumper must be adjusted as described in Adj. 6, Fig. 1, this section and rechecked and re-adjusted if necessary.

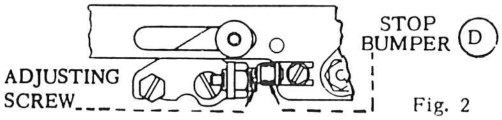


Fig. 2

FIG. 2 - OPTIONAL CLEAR SLIDE STOP BUMPER

With the right and left accumulator dial clear racks at their maximum travel as described in Fig. 1, the stop bumper "D" is to just contact the shift rack adjusting screw. To adjust, depress the carriage clear key and cycle the drive shaft to position the parts as shown in Fig. 1. Then adjust the stop bumper "D" as required.

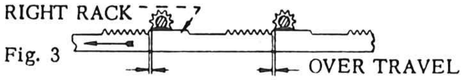


Fig. 3

FIG. 3 - CLEAR RACK OVERTRAVEL

(One - Piece Rack)

To check for proper clearing action, rotate the last four dials (extreme left) to 9's. Then with the carriage clear key depressed, rotate the drive shaft by hand. The accumulator dial clear rack is to clear the dials to zero and have a slight amount of overtravel. To adjust, turn the eccentric "A" as shown in Fig. 1.

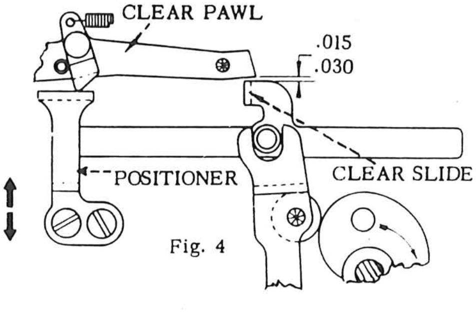


Fig. 4

FIG. 4 - LAST ORDER POSITIONER (Early Models)

With the carriage in the 2nd position and the clear slide all the way to the right, there is to be .015" to .030" clearance between the clear pawl and the clear slide. To adjust, raise or lower the positioner as required.

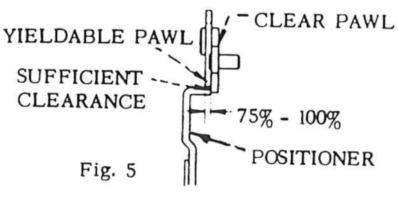
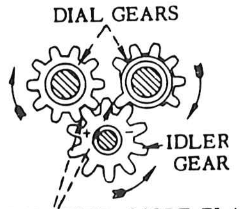


Fig. 5

FIG. 5 - ENGAGEMENT OF LAST ORDER POSITIONER (Early Models)

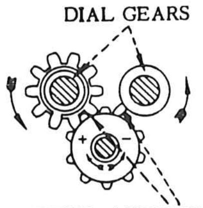
The positioner is to engage the yieldable pawl with a 75% to 100% engagement. To adjust, form the positioner.

ADJ. 10 - COMPLETE TRANSFER IDLER GEAR SECTION



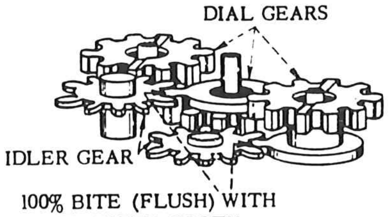
TOO DEEP. MORE PLAY HERE IN MINUS

Fig. 1



NOT DEEP. MORE PLAY HERE IN PLUS

Fig. 2



100% BITE (FLUSH) WITH TRANSFER TOOTH

Fig. 3

The idler gears are to engage the teeth on the dial gears so that: (1) The backlash (play) will be minimum and equally distributed between plus and minus. (2) The idler gears are to have a 100% bite (thickness of idler gear tooth) with the transfer teeth. (3) They are to be parallel with the transfer teeth, not tilted up or down.

To check these three conditions and also to observe the transfer motion, apply slight finger pressure on the 20th dial twirler knob while rotating the 12th accumulator dial gear (with the SS-57 tool) in first minus and then plus. Observe the idler gears and dial gears through the slot in the rear carriage frame and notice how the dials pick up as the transfer motion progresses from the 12th dial to the 20th dial.

If the idler gear section is in too deep (Fig. 1), there will be more delay in pick up between each dial as they turn in the minus direction. If the idler gear section is not deep enough (Fig. 2), there will be more delay in pick up between each dial as they turn in the plus direction. If the idler gears have less than a 100% bite with the transfer teeth they will have a tendency to cam themselves off the transfer tooth, and transfer failures will occur as well as rapid gear wear.

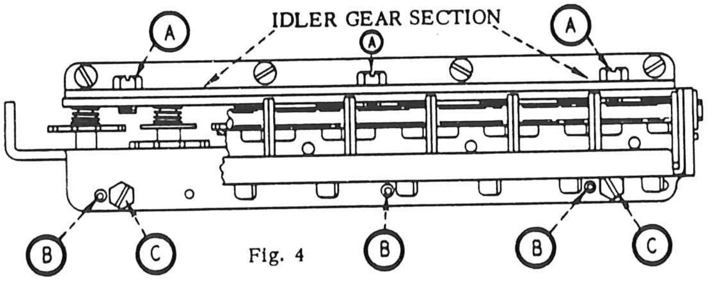
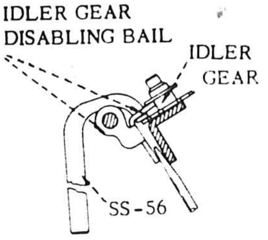


Fig. 4



Adjustment procedure: (Note: The screw holes in the upper plate of the idler gear section are enlarged so the idler gear section can be moved in or out from the top, as well as from the bottom. Both the upper and lower adjustment screws on the idler gear section are to be used to obtain the correct adjustment.)

1. With the upper screws "A" (Fig. 4), about mid position in the enlarged holes, and tight, back off the setscrews "B" completely so they do not contact the carriage frame.
2. Gently tighten the screws "C" an equal amount until the gear frame is flush with the carriage frame. This will bring the idler gears into maximum engagement with the dial gears. Next, back off the screws "C" approximately 2 turns, and tighten the screws "B" until a slight resistance is felt. DO NOT FORCE IN. The idler gear section frame will now have a slight clearance to the carriage frame and be parallel to it. Check the gear mesh, by turning the #12 accumulator dial

Continued on next page

ADJ. 10 - COMPLETE TRANSFER IDLER GEAR SECTION

with the SS-57 tool, and observe the transfer motion. Readjust screws "B" and "C" as required to increase or decrease the idler gear mesh. 1/12 of a turn on screws "B" and "C" may be sufficient. The idler gear section is to be as even as possible, although one end may need more adjusting to provide equal backlash or play at the ends.

3. Look through the opening in the carriage rear frame and check the amount of "bite" the idler gears have with their respective dial gear transfer teeth. The bite is to be as near 100% as possible. To increase or decrease the bite, loosen the screws "A" and move the idler gear section upper frame in or out to obtain the desired bite. Tighten the screws "A" and recheck the transfer motion. It may be necessary to readjust screws "B" and "C" slightly.

Note: For individual adjustment of an idler gear engagement or disengagement, use special tool SS-56 to form the idler gear disabling bail.

ADJ. 11 - CARRIAGE CLEAR

TOP VIEW

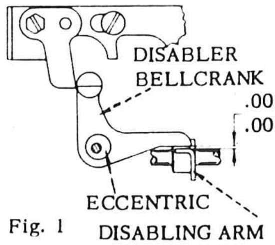
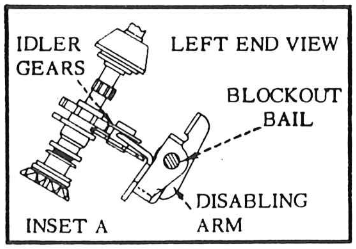
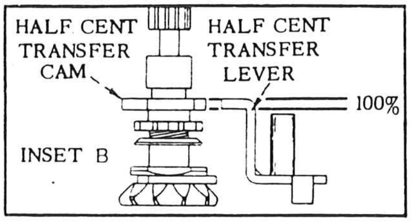


Fig. 1





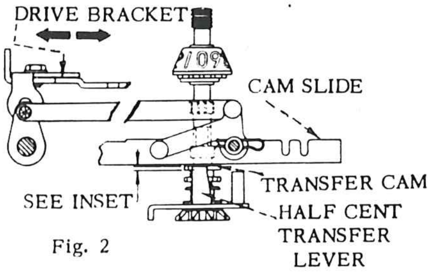


Fig. 2

FIG. 1 - COMPLETE TRANSFER CARRIAGE

(1) With the optional clear slide in home position, there is to be .002" to .003" clearance between the disabling arm and the disabler bellcrank.

(2) With the optional clear slide pulled all the way to the right, the disabling arm is to move the blockout bail (Inset A) rearward as far as possible without bottoming; and the idler gears are to raise before the dials rotate.

To adjust, turn the eccentric as required.

FIG. 2 - CARRIAGE WITH FRACTIONAL CENT DIALS

(1) During normal operation, the fractional cent transfer cams must have 100% engagement with the fractional cent transfer levers as shown in the Inset B.

(2) During carriage clear, the fractional cent transfer cam must have safe clearance to the fractional cent transfer lever.

To adjust, move the drive bracket to the left as far as it will go. This depresses the cam slide until the transfer cams and the fractional cent transfer levers have 100% engagement. On a clearing operation, the cam slide must raise the transfer cam so the fractional cent transfer lever is not contacted as the dial is rotated by the clear rack. To test: Pull the optional clear slide to the right; turn the fractional cent dials to a 5; restore the slide; turn the same dials to a "O". Hold thumb on fractional cent transfer lever and push out on the optional clear slide. If the transfer cam contacts the fractional cent transfer lever, move the drive bracket to the right. Also recheck Adj. 6 (Section 5) Fig. 2, regarding the note for keeping the zero stop slide toward the left zero stop cam.

Note: When checking this adjustment pull the optional clear slide to move the clear rack. DON'T pull the clear rack to move the optional clear slide.

ADJ. 12 - COMPLETE TRANSFER DISENGAGEMENT

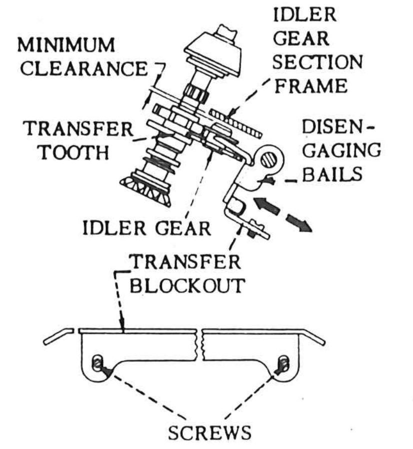


Fig. 1

FIG.1-TRANSFER BLOCKOUT DISENGAGEMENT

With the carriage shifted to the right and the disengaging bails contacting the transfer blockout, the idler gears must be disengaged from the transfer teeth on the transfer gears with a safe clearance. To adjust, position the carriage all the way to the right and move the transfer blockout rearward. To check the safe clearance, move the carriage one-half shift to the left and rotate the full capacity dials. Each dial is to turn freely without causing a transfer "flicker" in the dial to its left.

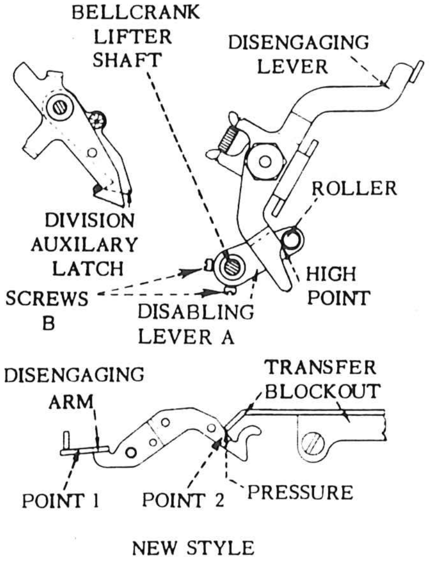


Fig. 2

FIG. 2-BLOCKOUT DURING DIVISION (NewStyle)

To insure safe idler gear disengagement during a division operation, manually cycle the machine in division until the division auxiliary latch is delatched. Then loosen screw "B" and rotate the disabling lever "A" until the high point of the disengaging lever is centered on the roller as shown. Next, adjust the disengaging arm at point 1 so point 2 is resting with SLIGHT pressure on the transfer blockout.

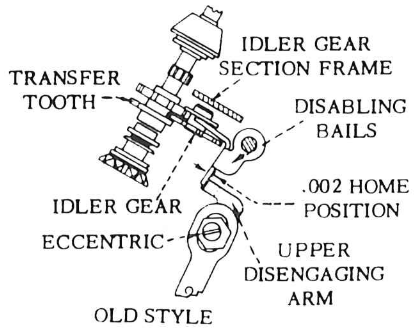


Fig. 3

FIG. 3 - BLOCKOUT DURING DIVISION

(Models 1951 to 1955)

To adjust the idler gear disengagement for this series of machines, condition the machine and adjust the disabling lever "A" as described in Fig. 2. Then adjust the eccentric to disengage the idler gear from the transfer tooth as shown. With the machine in home position, check to see that the upper disengaging arm has .002" clearance to the disabling bails.

Continued on next page

ADJ. 12 - COMPLETE TRANSFER DISENGAGEMENT

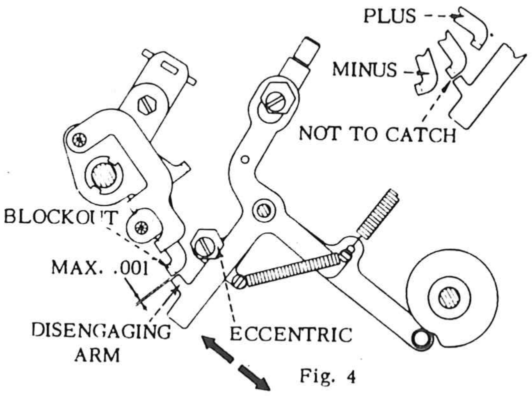


Fig. 4

FIG. 4 - BLOCKOUT DURING DIVISION

(Models prior to 1951)

When the carriage is to the extreme left and the machine is in home position, there is to be a very close clearance (approximately .001") between the disengaging arm and the blockout. Also the blockout is not to catch on the disengaging arm when the add - subtract gate is moved manually from plus to minus. Adjust at the eccentric.

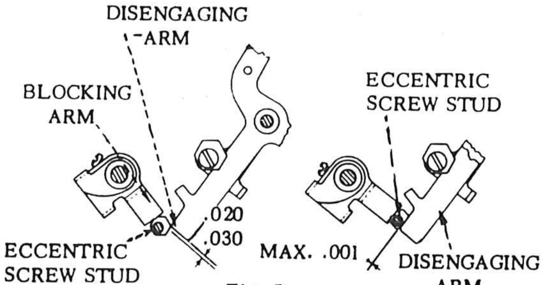


Fig. 5

FIG. 5 - BLOCKOUT DURING DIVISION

(Models prior to 1951)

When the machine is in home position, the eccentric screw stud is to clear the disengaging arm by .020" to .030". Adjust by moving the blocking arm. When the machine is latched in division, the eccentric screw stud, is to clear the disengaging arm by a maximum of .001". Adjust the eccentric screw stud.

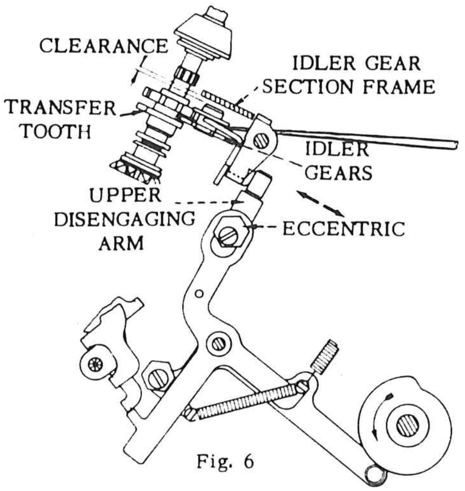


Fig. 6

FIG. 6 - BLOCKOUT DURING DIVISION

(Models prior to 1951)

Place the carriage to the extreme left; release the clutch and cycle the drive shaft one half turn. The idler gears are to be held above the transfer teeth but are not to be tight against the idler gear section frame. Adjust the eccentric to raise or lower the idler gears. The rear carriage straps must be adjusted properly to hold the carriage steady. Use the pick up test by rotating the dials by the twirler knobs from "0" through "9", to "8", and back through "9" to "1". There is to be no attempt to transfer to the next dial to the left. Any movement indicates the idler gears are not being held high enough. If the idler gears are raised too high they will bind against the idler gear section frame. Test for this by inserting a spring hook and feeling for small clearance by raising the idler gear.

ADJ. 13 - CLEARANCE TO OVERRIDE PAWLS AND CARRIAGE END STOPS

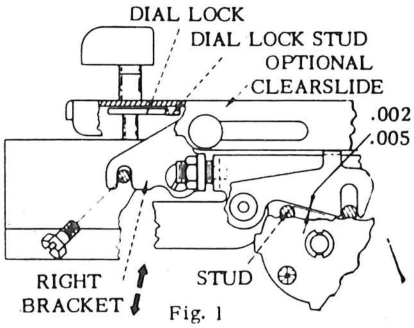


Fig. 1

FIG. 1 - CLEARANCE TO RIGHT OVERRIDE PAWL

With the carriage shifted to the extreme left and the carriage shift gear centralized, adjust the right bracket to obtain .002" to .005" clearance between the right override pawl and the stud on the carriage shift gear.

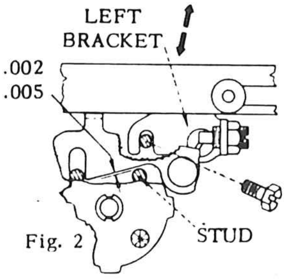


Fig. 2

FIG. 2 - CLEARANCE TO LEFT OVERRIDE PAWL

With the carriage shifted to the extreme right and the carriage shift gear centralized, adjust the left bracket to give .002" to .005" clearance between the left override pawl and the stud on the carriage shift gear.

Note: After adjusting for the clearance, check to see that the dial locks have good engagement with the studs on the optional clear slide.

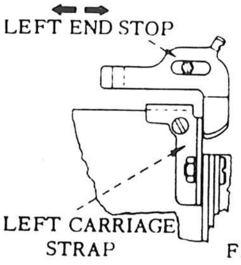


Fig. 3

NEW AND OLD STYLE

FIG. 3 - LEFT END STOP

With the carriage shifted to the extreme right and the carriage shift gear centralized, the left end stop is to have minimum clearance to the carriage strap or bearing plate. To adjust, shift the carriage all the way to the right; apply light pressure against the left end of the carriage to centralize the shift gear; then move the end stop against the carriage strap and tighten the screw.

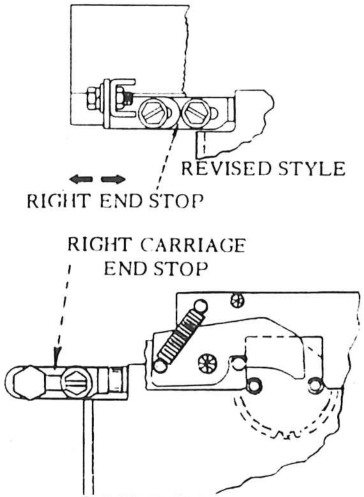


Fig. 4

FIG. 4 - RIGHT END STOP

With the carriage shifted to the extreme left and the carriage shift gear centralized, the right end stop is to have minimum clearance to the bearing plate. To adjust, shift the carriage to the extreme left; apply slight pressure against the right end of the carriage to centralize the shift gear; then move the end stop against the bearing plate and tighten the screw.

To check, operate the machine by crank in right and left shift to see that the shift gear lugs do not drag or bind when the carriage shifts out of the left or the right override positions. Also that the override pawl repositions itself to the shift gear.

Continued on next page

CARRIAGE

ADJ. 13 - CLEARANCE TO OVERRIDE PAWLS AND CARRIAGE END STOPS

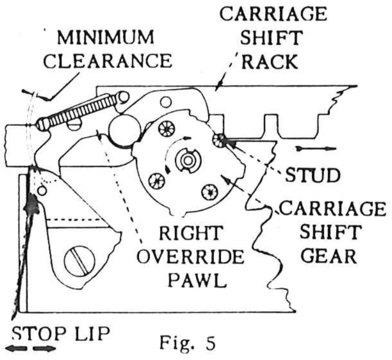


Fig. 5

FIG. 5 - RIGHT OVERRIDE PAWL AND STOP LIP

With the carriage shifted to the extreme left and the override pawl on its high point of movement, there is to be minimum clearance between the override pawl and the stop lip. To adjust, form the stop lip. Check to see that the override pawl repositions itself freely, and does not bind or hang up on the stop lip during the override movement.

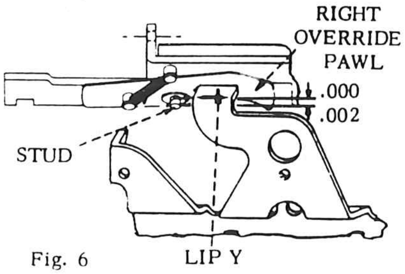


Fig. 6

FIG. 6 - CLEARANCE TO STUD ON RIGHT OVERRIDE PAWL

With the carriage shifted to the extreme left, there is to be .002" maximum clearance between the stud on the right override pawl and Lip "Y" on the shift gear bearing plate. To Adjust, form Lip "Y". Check to see that the stud passes freely under Lip "Y".

ADJ. 14 - CARRIAGE SHIFT INTERLOCKS (Hand Models)

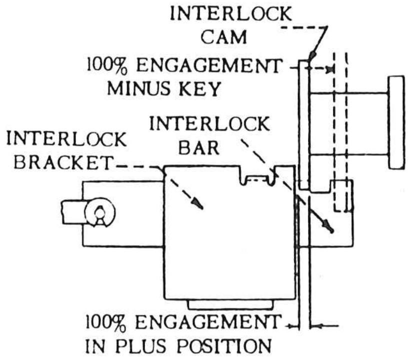


Fig. 1

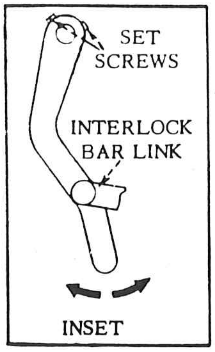
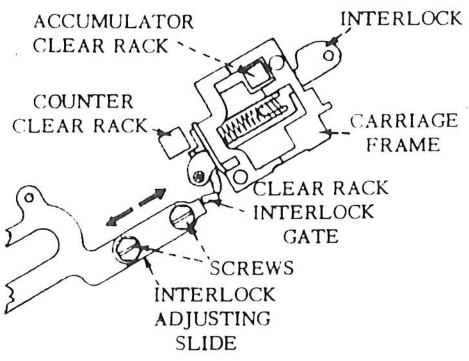


FIG. 1 - SHIFT INTERLOCK

With the drive shaft in a half cycle, in either plus or minus operation, there is to be 100% engagement of the interlock cam with the interlock bar. To adjust, move the interlock bar link shown in the Inset.



HOME POSITION

Fig. 2

FIG. 2 - CLEAR RACK INTERLOCK

When the machine is cycled in plus or minus, the interlock is to block the counter and the accumulator clear racks. In home position, the clear racks are not to be interlocked. To adjust, move the interlock adjusting slide as required.

Continued on next page

ADJ. 14 - CARRIAGE SHIFT INTERLOCKS (Hand Models)

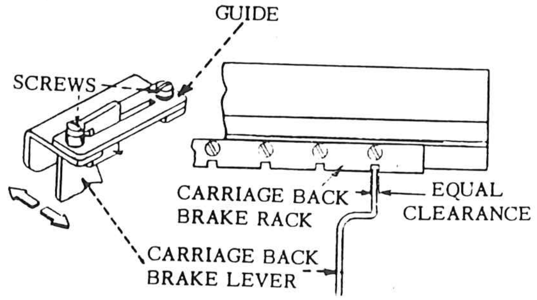


Fig. 3

FIG. 3 - CARRIAGE BACK BRAKE LEVER

With the carriage centralized, there is to be equal clearance between the carriage back brake lever and the slots in the back brake rack. To adjust, move the back brake lever guide as required.

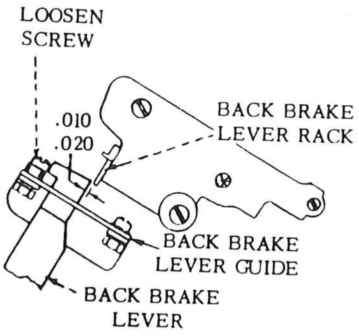


Fig. 4

FIG. 4 - CARRIAGE BACK BRAKE LEVER

There is to be .010" to .020" clearance between the back brake lever and the back brake lever rack. To adjust, loosen and tap the screw in the direction required.

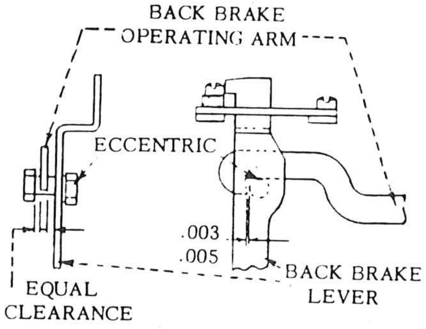


Fig. 5

FIG. 5 - BACK BRAKE OPERATING ARM

The lip on the back brake operating arm is to engage the eccentric stud on the back brake lever with equal side clearance and have .003" to .005" overlatch. To adjust the overlatch, turn the eccentric as required. To adjust for equal side clearance, form the operating arm.

ADD-SUBTRACT GATE

ADJ. 1 - ALIGNMENT OF ADD-SUBTRACT GATE TO ACCUMULATOR DIALS

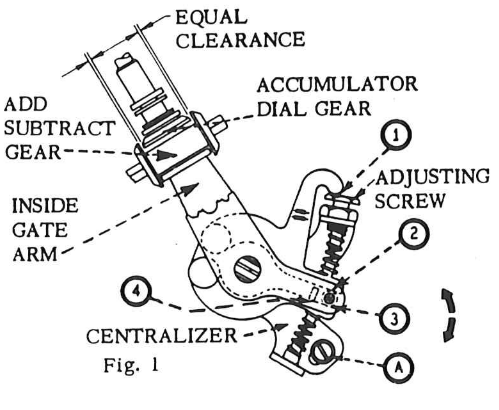
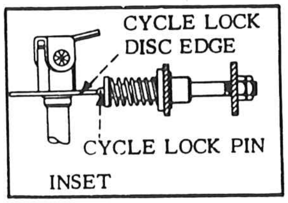


Fig. 1



INSET

FIG. 1 - GATE CENTRALIZER AND POINTS OF CONTACT

(1) In home position, the centralizer arms are to have four points of contact as shown. The upper arm is to contact at points 1 and 2, and the lower arm at points 3 and 4.

(2) With the add subtract gate in home (neutral) position, the add-subtract gears must have equal clearance to the accumulator dial gears, and the cycle lock pin must ride in the approximate center of the cycle lock disc (edge) as shown in the inset.

To adjust the 4 points of contact, turn the upper adjusting screw as required. (Note: Current model machines do not have a lower adjusting screw. On earlier model machines having the lower adjusting screw, the screw is to have approximately four threads extending through the bracket.)

To adjust the add-subtract gate for equal clearance to the accumulator dial gears move the centralizer screw A. Check the cycle lock pin to see that it rides the approximate center of the cycle lock disc.

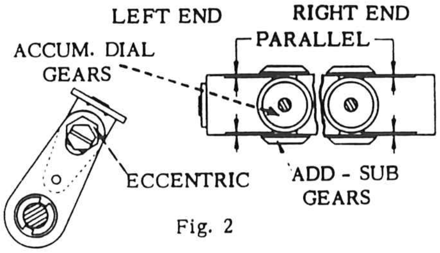


Fig. 2

FIG. 2 - GATE CENTRALIZER (Left End)

With the right end of the gate centralized as described in Fig. 1, the left end of the gate must be adjusted for equal clearance of the add-subtract gears to the accumulator dial gears. To adjust, turn the eccentric at the left end of the add-subtract gate. Note: Some models do not have the eccentric adjustment, but the alignment can be obtained by twisting the add-subtract gate.

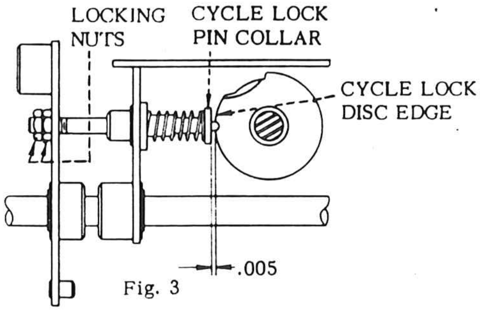


Fig. 3

FIG. 3 - CYCLE LOCK PIN

With the drive shaft half cycled in either plus or minus, there is to be .005" clearance between the collar on the cycle lock pin and the edge of the cycle lock disc. To adjust, half-cycle the drive shaft in plus or minus; then turn the locking nuts on the end of the cycle lock pin as required.

ADD-SUBTRACT GATE

ADJ. 2 - ADD-SUBTRACT GEAR MESH

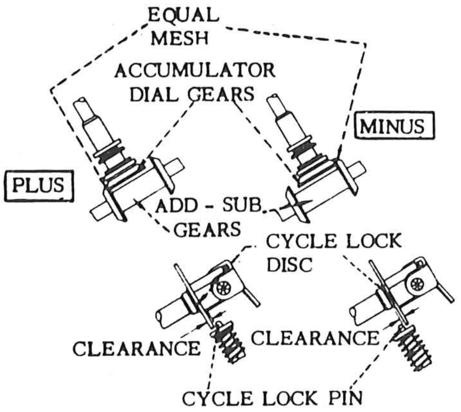


Fig. 1

FIG. 1 - ADD - SUBTRACT GEAR MESH AND CYCLE LOCK PIN

With the add-subtract gate positioned in either plus or minus (Fig. 1), the add-subtract gears are to have equal mesh with the accumulator dial gears and the cycle lock pin is to have clearance to the cycle lock disc. To adjust, follow the adjustment procedure specified for the model machine indicated in the figure headings.

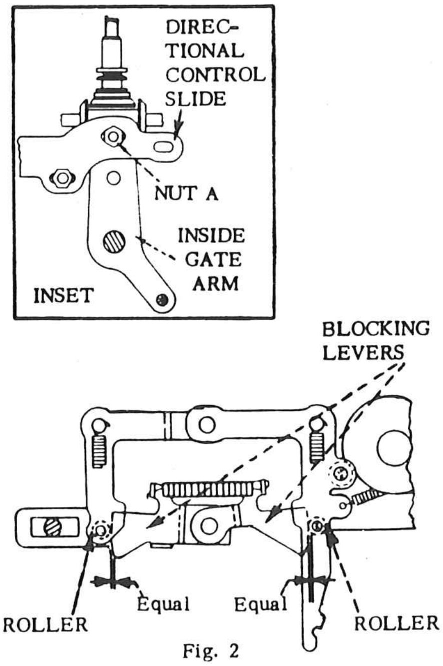


Fig. 2

FIG. 2 - DIRECTIONAL CONTROL SLIDE

(Power Set Gate)

With Nut "A" on the directional control slide loose (per the Inset), manually depress the blocking levers and move the directional control slide until there is equal movement between the blocking levers and their rollers. Tighten Nut "A".

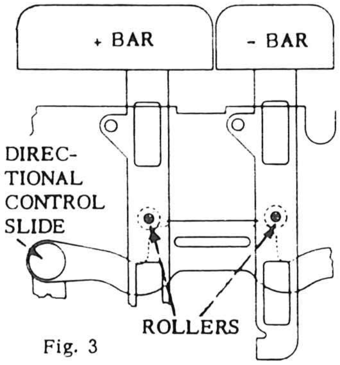


Fig. 3

FIG. 3 - DIRECTIONAL CONTROL SLIDE

(Standard Models

With Nut "A" loose (per the Inset), depress both the plus and minus keys to centralize the directional control slide. Then while holding the keys depressed, tighten Nut "A".

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ADD-SUBTRACT GATE

ADJ. 2 - ADD-SUBTRACT GEAR MESH

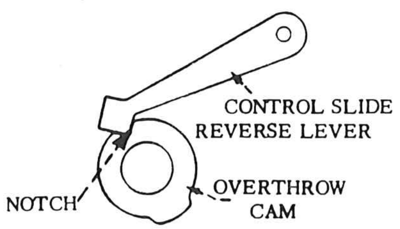

Fig. 4

FIG. 4 - DIRECTIONAL CONTROL SLIDE

(Hand Models)

With Nut "A" loose (per the Inset), depress the control slide reverse lever into the notch on the overthrow cam. Then while holding in this position, tighten the Nut "A".

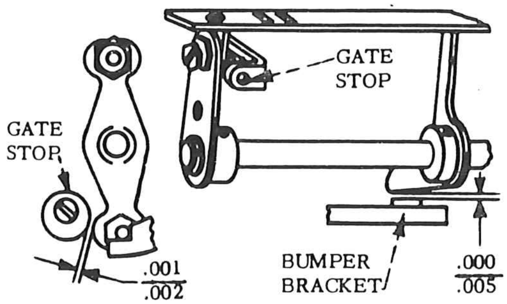

Fig. 5

FIG. 5 - GATE STOP

(1) With the machine cycled under power with the plus key held depressed the gate bumper arm is to have .000" to .005" clearance to the stop. To adjust, form the bumper bracket.

(2) With the machine cycled in negative mult until the power set cam is on the high point of movement with the roller, the gate stop (eccentric washer or revised bumper bracket) is to have .001" to .002" clearance. To adjust, turn the eccentric or move the bracket.

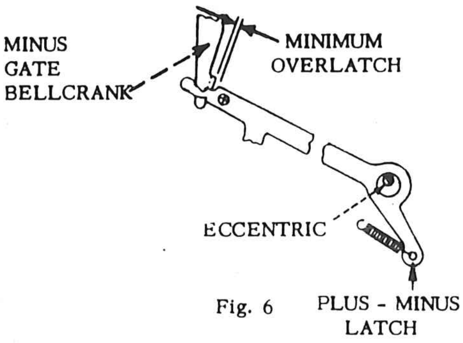

Fig. 6

FIG. 6 - PLUS - MINUS LATCH (Power Set Gate)

With the machine operated under power and the plus key held down, the gate is not to flicker. To adjust, turn the eccentric on the plus-minus latch until the overlatch between the minus gate bellcrank and the plus-minus latch is minimum.

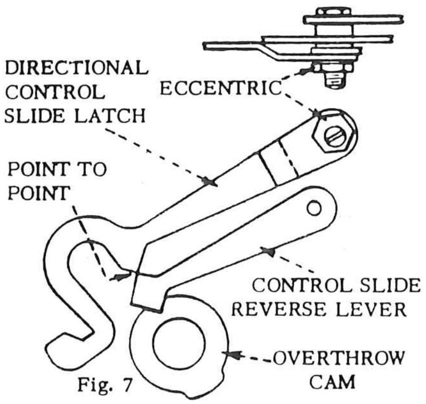

Fig. 7

FIG. 7 - DIRECTIONAL CONTROL SLIDE LATCH

(Hand Models)

The point of the directional control slide latch is to be positioned over the point of the control slide reverse lever as shown. To adjust, turn the eccentric on the directional control slide latch.

ADJ. 1 - COUNTER CARRIER ASSEMBLY

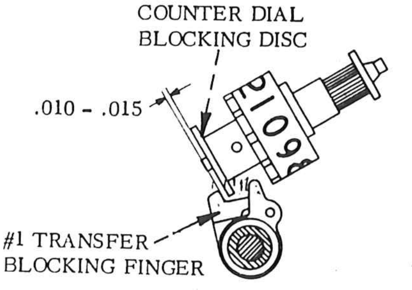

Fig. 1

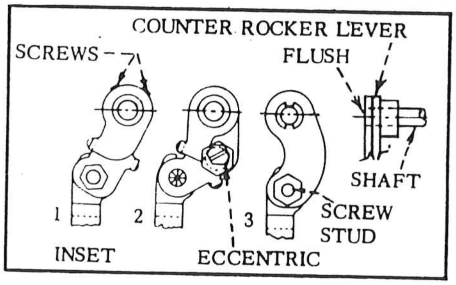

FIG. 1 - COUNTER ROCKER LEVER

With the machine in home position and the carriage all the way to the left, the #1 secondary finger is to have .010" to .015" clearance to the counter dial blocking disc. To adjust, rotate the counter forward or rearward by one of the adjustment means shown in the Inset.

Style 1 - loosen the set screws and rotate the counter shaft. Keep the end of the shaft flush with the rocker lever.

Style 2 - move the eccentric on the rocker lever.

Style 3 - loosen the screw stud to move the rocker lever.

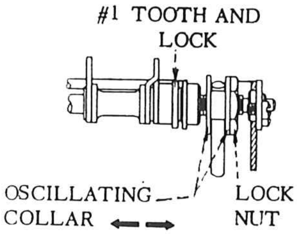

Fig. 2

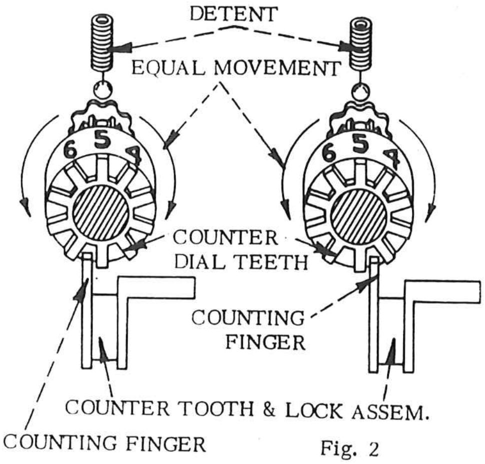

Fig. 2

FIG. 2 - COUNTER OSCILLATING LEVER

1. Check to see that the counting finger is straight. (The counting finger is the rear finger on the #1 counter finger assembly at the extreme right end of the counter carrier.)

2. Shift the carriage one or more spaces out of home position.

3. Rotate a "5" in the counter dial over the counting finger.

4. Depress the plus key and cycle the drive shaft until the counting finger moves forward and fully engages the counter dial gear with the "5". (Note: At this point the counter is to have no lateral movement.)

5. Check for equal clearance between the counting finger and the dial tooth by rotating the dial from side to side. Repeat the same procedure for the "minus" key operation.

To adjust, loosen the lock nut and move the counter carrier right or left by turning the oscillating collar as shown. Then tighten the lock nut and check for proper engagement.

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COUNTER

ADJ. 1 - COUNTER CARRIER ASSEMBLY

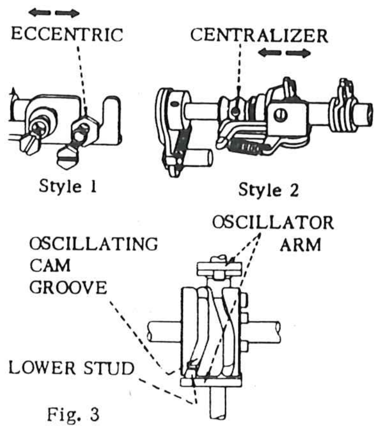


Fig. 3

FIG. 3 - COUNTER CENTRALIZER

The upper and lower studs on the oscillator arms are to enter the cam grooves on the oscillator cam without binding. To adjust, move the add-subtract gate to the plus position. Then move the centralizer (style 1 or style 2) to obtain equal right and left movement. Repeat the same procedure for minus.

Note: Whenever the counter is moved, it is always necessary to readjust the counter centralizer.

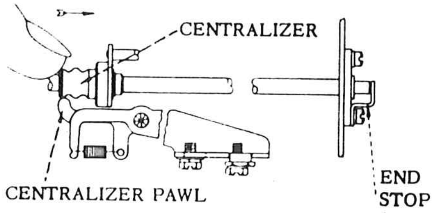


Fig. 4

FIG. 4 - COUNTER END STOP

The end stop is to prevent the centralizer pawl from catching on the left edge of the centralizer. To adjust, form the end stop. Check by pushing the counter to the right. When released, the counter carrier is to centralize without hesitation.

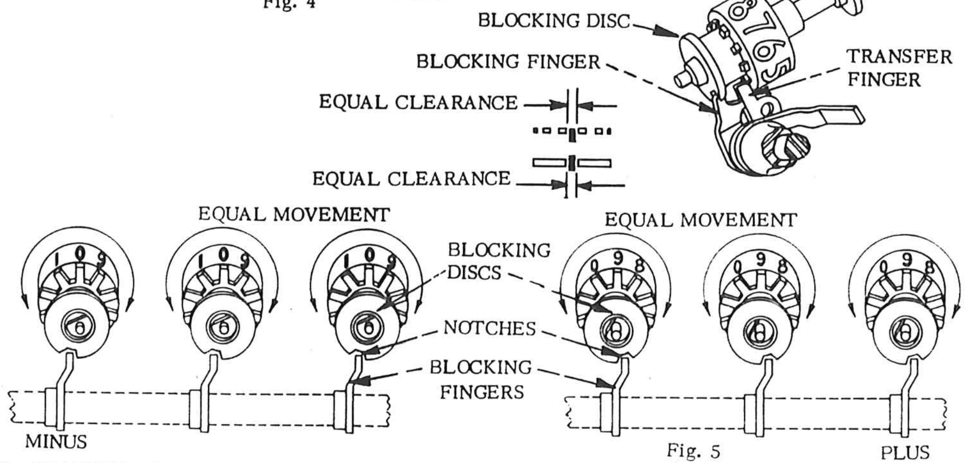


Fig. 5

FIG. 5 - TRANSFER FINGERS & BLOCKING FINGERS

With the carriage in home position and all counter dials at "0", cycle the machine in "minus". The transfer fingers and blocking fingers are to move into engagement with their respective counter dial gear teeth and blocking disc transfer notches with equal clearance between the fingers and the gear teeth or blocking disc notches. Check by rocking the dials.

Next, rotate the counter dials to all 9's and cycle the machine in "plus". Then again check for equal clearance between the fingers and the dial gear teeth by rocking the dials.

To adjust, form the individual transfer and blocking fingers right or left as required.

NOTE: The counting finger is already adjusted by means of the oscillating collar as explained in Fig. 2. Do not form the counting finger for this adjustment.

Continued on next page

ADJ. 1 - COUNTER CARRIER ASSEMBLY

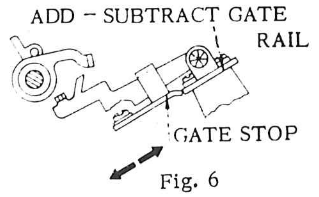


Fig. 6

FIG. 6 - GATE STOP

With the minus key held depressed and the drive shaft half-cycled, the gate stop is to contact the gate rail. To adjust, move the gate stop.

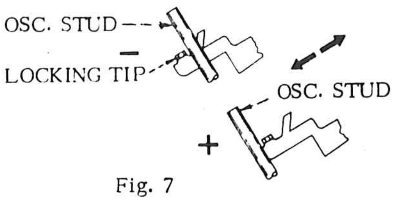


Fig. 7

FIG. 7 - LOCKING TIP

The locking tip is to have equal clearance to the oscillator stud in both plus and minus operation. To adjust, form the locking tip. Check under power in plus and minus to see that the gate does not bounce due to the oscillator stud contacting the locking tip. Also check by pulling the left end of the counter carrier and then manually move the add-subtract gate to the plus position. The counter is to be blocked by the locking tip. Try the same test with the gate moved to the minus position.

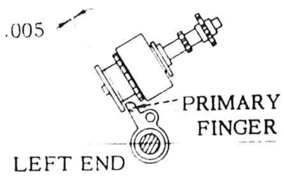


Fig. 8

FIG. 8 - CLEARANCE OF PRIMARY FINGERS TO BLOCKING DISCS

The primary fingers on the left end of the counter carrier are to have .005" clearance to the counter dial blocking discs. To adjust, form the primary fingers. Check by shifting the carriage to the extreme left and sighting along the underside of the carriage.

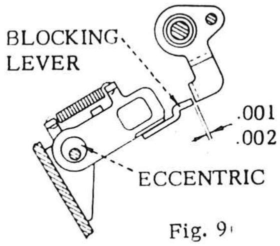


Fig. 9

FIG. 9 - COUNTER NON - ENTRY LEVER

With the counter non-entry lever pulled forward, there is to be .001" to .002" clearance between the blocking lever and the counter blockout. To adjust, turn the eccentric as required.

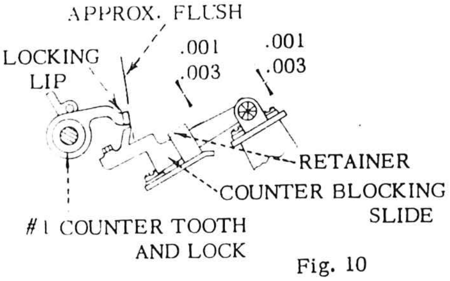


Fig. 10

FIG. 10 - COUNTER BLOCKING SLIDE

(1) The counter blocking slide is to clear the locking lip of the #1 counter tooth and lock assembly by .001" to .003". To adjust, brace the counter and form the locking lip. Use tool SS-61. Check the clearance by moving the add-subtract gate from plus to minus.

(2) The counter blocking slide is to have .001" to .003" clearance to the retainer. To adjust, form the retainer.

(3) With the machine in home position, the rear point on the counter blocking slide is to be approximately flush with the rear of the locking lip. To adjust, move the counter blocking slide.

ADJ. 2 – COUNTER REVERSE CAM, LEVER, AND OSCILLATOR ARM

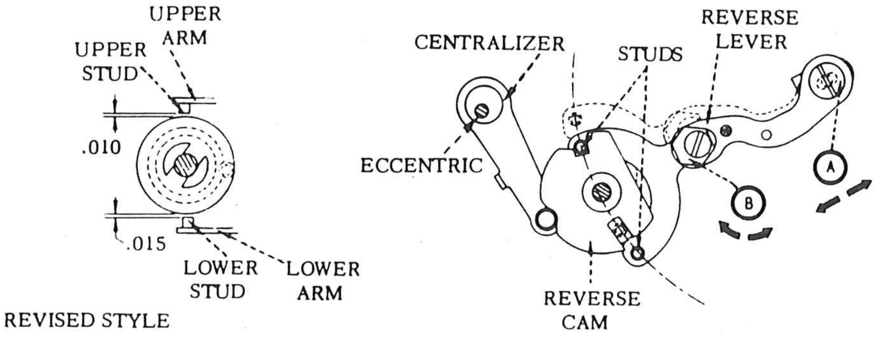


FIG. 1 - MODEL WITH SHORT LOWER-STUD

(1) With the drive shaft rotated until the upper stud on the oscillator arm is over the wide space on the oscillator cam, the upper stud is to clear the cam by .010" and the lower stud is to clear the cam by .015". To adjust, rotate the centralizer eccentric. If necessary, form the lower arm.

(2) The studs on the counter reverse lever are to move in and out of their respective cam slots without contacting the slot edges. To adjust, rotate eccentric "B" to equalize the upper and lower studs, then loosen screw "A" and slide the reverse lever forward or rearward.

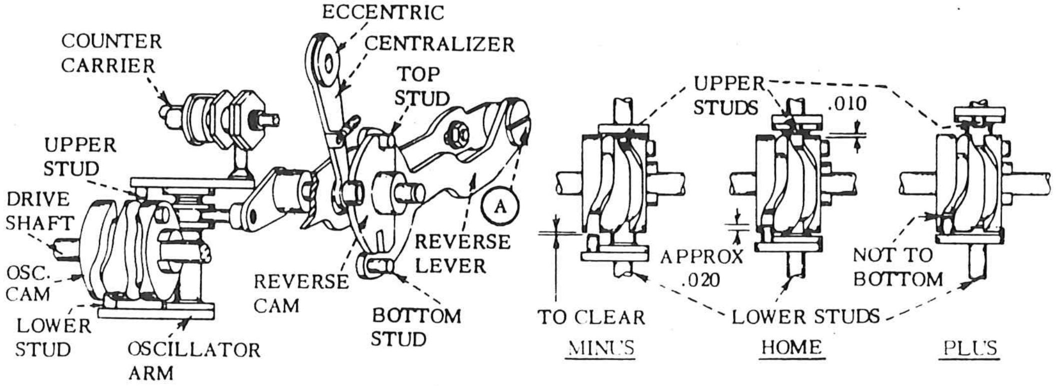


FIG. 2 - MODEL WITH LONG LOWER-STUD

(1) The studs on the counter reverse lever are to move in and out of their respective cam slots without contacting the slot edges. To adjust, equalize the upper and lower studs by rotating the eccentric on the reverse cam centralizer.

(2) The studs on the counter reverse lever are to have equal clearance in the slots. To adjust, move the reverse lever at screw "A".

(3) With the drive shaft rotated until the upper stud on the oscillator arm is over the wide space on the oscillator cam, the upper stud is to clear the cam by .010". Normally the adjustment of the centralizer (step. 1) will take care of this clearance. If not, it will be necessary to form the upper arm.

(4) With the upper stud in the slot on the counter reverse cam, depress the plus key and half-cycle the drive shaft. The lower stud is not to bottom in the cam groove. With the drive shaft half-cycled in minus, the lower stud is to have clearance to the cam; and with the carriage in a shift cycle, the stud is to engage the cam approximately .020". To adjust, form the lower arm.

ADJ. 3 - COUNTER CONTROL

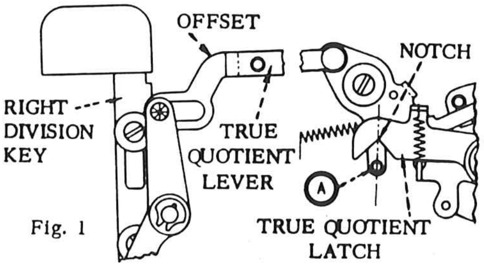


Fig. 1

FIG. 1 - STEP 1

With the machine in home position and the right division key depressed, stud "A" on the true quotient lever is to align with the notch on the true quotient latch. To adjust, form the true quotient lever at the offset.

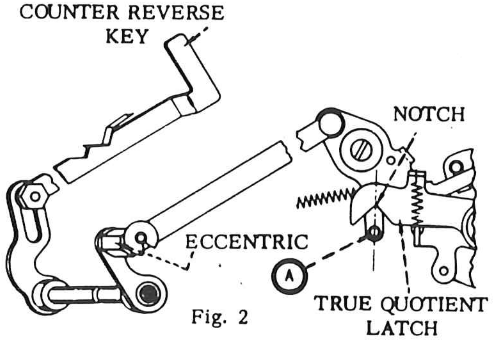


Fig. 2

FIG. 2 - STEP 2

(Models Without Gradient Control)

With the counter reverse key in the forward position, stud "A" is to align with the notch on the true quotient latch. To adjust, rotate the eccentric.

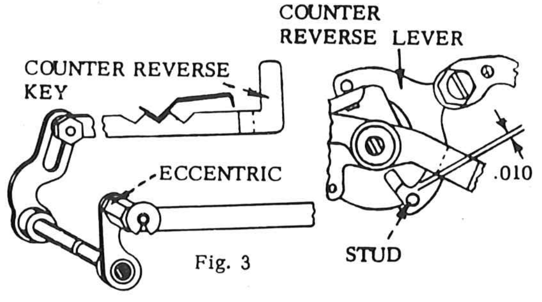


Fig. 3

FIG. 3 - STEP 3

(Models with Gradient but not Sel. Transfer)

When the counter reverse key is in the gradient position and the gate is moved to the plus position, the lower stud on the counter reverse lever is to clear the cam lobe by .010". To adjust, rotate the eccentric.

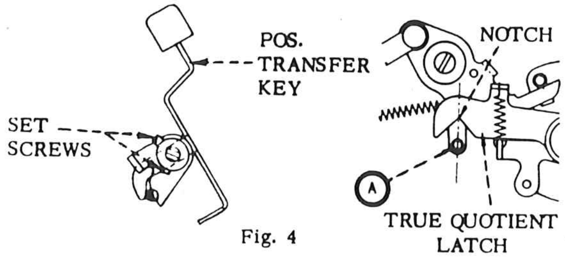


Fig. 4

FIG. 4 - STEP 2

(Models with Selective Transfer)

With the eccentric (shown in Fig. 2) rotated so the high side is straight up and the positive transfer key depressed, the stud "A" is to align with the notch on the true quotient latch. To adjust, loosen the set-screws and rotate the shaft.

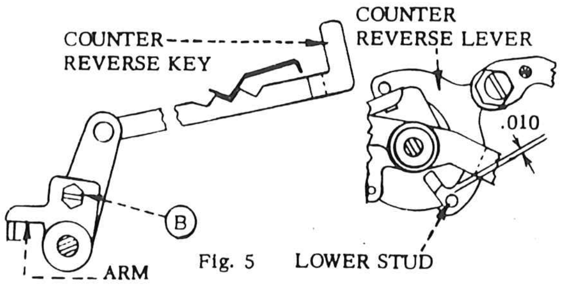


Fig. 5

FIG. 5 - STEP 3

(Models with Grad. & Sel. Transfer)

With the counter reverse key in the gradient position, move the add-subtract gate to the plus position. As the gate is moved to the plus position the lower stud is to clear the lobe on the counter reverse cam by .010". To adjust, loosen screw "B" and rotate the arm.

ENTER DIVIDEND

ADJ. 1 - KEY LATCHING AND DELATCHING

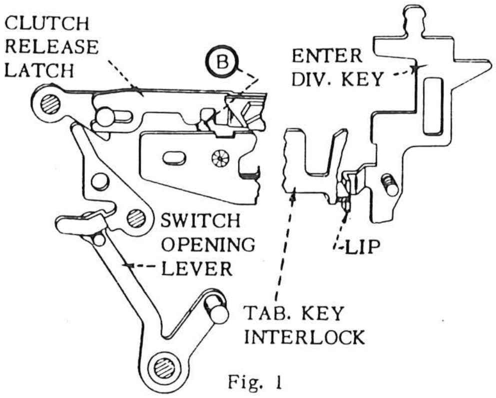


Fig. 1

FIG. 1 - DISENGAGING THE CLUTCH RELEASE LATCH (Models without Power Set Gate)

With the machine in home position, the clutch release latch is to be fully seated on stud "B". When the enter dividend key is depressed, the clutch release latch must be raised off of stud "B" just as the tab key interlock contacts the Lip on the enter dividend key.

To adjust, form the switch opening lever. Check by slowly depressing the enter dividend key. The key is not to have a noticeable drag.

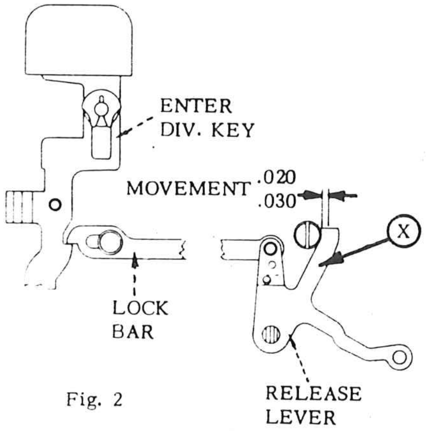


Fig. 2

FIG. 2 - KEY LATCHING

When the enter dividend key is depressed, the lock bar must engage the Lip on the key lever by approximately .020" to .030". This engagement cannot be seen, but it can be checked by observing the movement of the release lever as the enter divident key is slowly depressed. To adjust, form the release lever at "X".

ADJ. 2 - SHIFT SET-UP ENGAGEMENT & DISENGAGEMENT

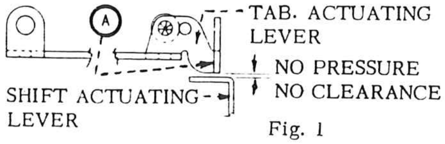


Fig. 1

FIG. 1 - TABULATOR ACTUATING LEVER

The tab actuating lever is to have no clearance and no pressure on the shift actuating lever. To adjust, form the tab actuating lever at point "A".

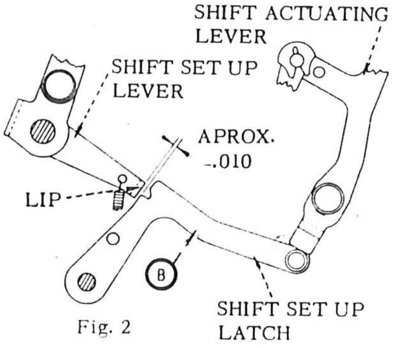


Fig. 2

FIG. 2 - SHIFT SET-UP LATCH (Step 1)

With the carriage shifted out of home position, depress the enter dividend key and cycle the drive shaft one revolution to latch the shift oscillating lever roller on the oscillating latch. Locate the tab stop just above the shift actuating lever and latch it down so the shift actuating lever is held depressed. The clearance between the lip on the shift set-up lever and the shift set-up latch is to be approximately .010". To adjust, form the shift set-up latch at point "B".

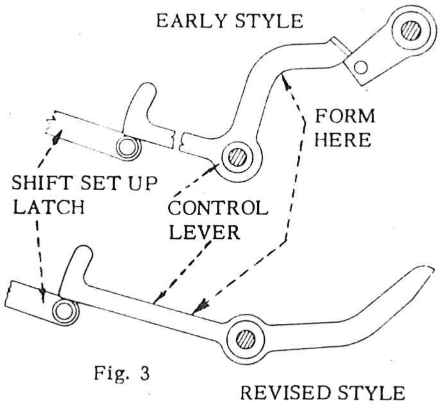


Fig. 3

FIG. 3 - SHIFT SET-UP LATCH (Step 2)

With the drive shaft in home position, the carriage positioned all the way to the left, and with no tab stop depressed; there is to be approximately .010" clearance between the Lip on the shift set-up lever and the shift set-up latch as shown in Fig. 2. To adjust, form the control lever (revised or early style) at the point shown.

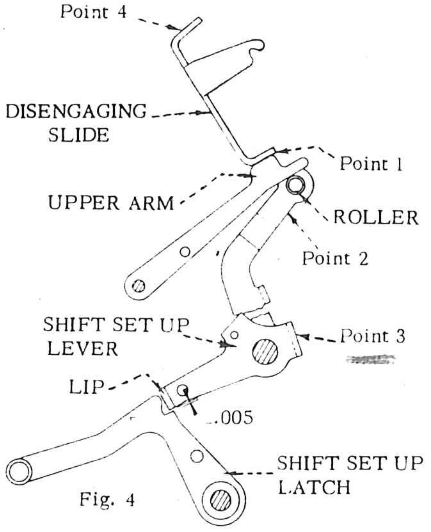


Fig. 4

FIG. 4 - LATCHING OF SHIFT SET-UP LEVER

With the enter dividend key depressed, cycle the drive shaft until the carriage shift gear is at the high point of the override (disengaging slide at maximum downward travel). At this point, the shift set-up lever is to overlatch the shift set-up latch by .005". To adjust, form at any of the 4 adjustment points as shown. Note: Excessive clearance will effect other adjustments. Hold the adjustment as close to the specified clearance as possible.

ADJ. 3 - DELATCHING LEVER CLEARANCE TO TRIP LEVER

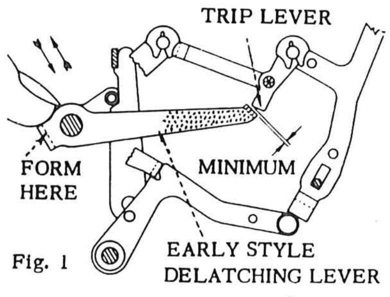


Fig. 1

FIG. 1 - EARLY STYLE

With no tab stop depressed, cycle the machine in enter dividend until the carriage is shifting to the right. At this point there is to be minimum clearance between the delatching lever and the trip lever. To adjust, form the delatching lever at point shown. Check the clearance by pressing on the delatching lever to raise it up and down.

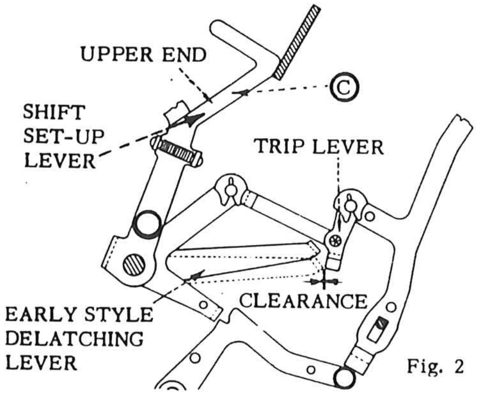
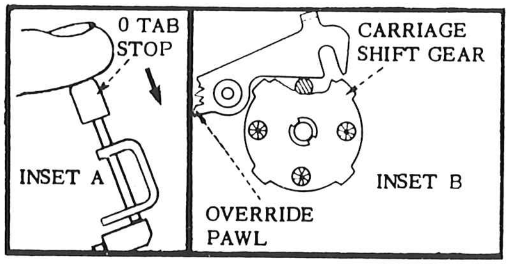


Fig. 2

FIG. 2 - EARLY STYLE

With no tab stop depressed (machine in home position), swing the delatching lever up and down. The delatching lever is to clear the trip lever with minimum clearance. To adjust, form the upper end at point "C".



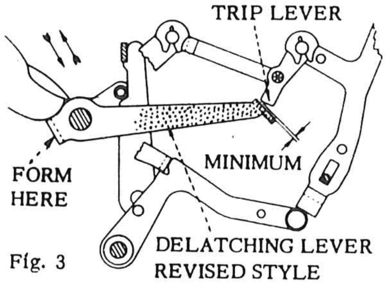


Fig. 3

FIG. 3 - REVISED STYLE

With the enter dividend key depressed, cycle the drive shaft until the carriage shift gear is positioned as shown in Inset B. There is to be minimum clearance between the delatching lever and the trip lever. To adjust, form the delatching lever at point shown.

Remove to Form

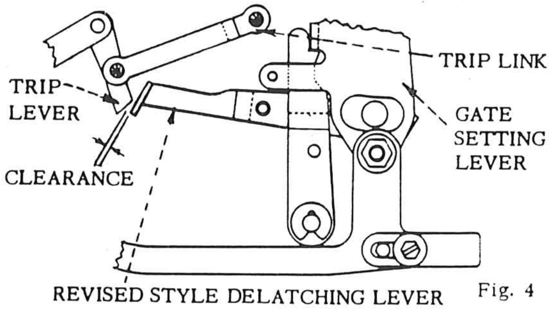


Fig. 4

FIG. 4 - REVISED STYLE

With the carriage to the extreme left and the drive shaft in home position, depress the "O" tab stop shown in Inset A. The clearance between the delatching lever and the trip lever is to be such that a sharp depression of the "O" tab stop will not delatch the gate setting lever. To adjust, form the upper end of the shift set-up lever as shown in Fig. 2. Also recheck the adjustment described in Fig. 3.

ADJ. 4 - GATE ENGAGING

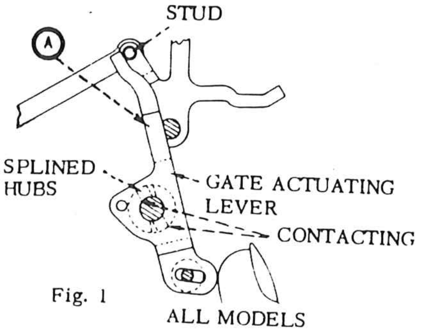


Fig. 1

FIG. 1 - ALL MODELS

With light pressure against the lower end of the gate actuating lever (to take up the play in the splined hubs), the upper end of the gate actuating lever is to touch the stud on the enter dividend key lock bar. To adjust, form the gate actuating lever at point "A".

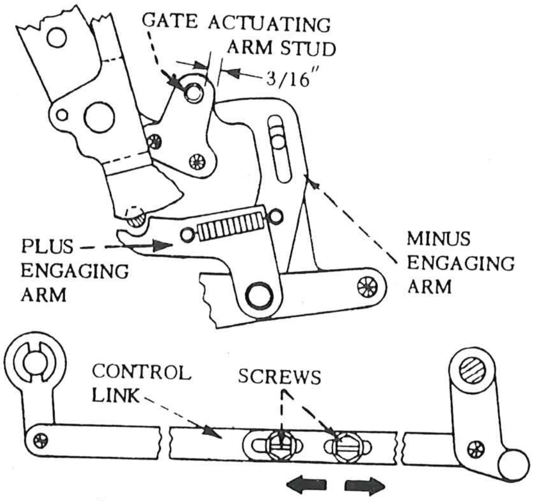


Fig. 2

FIG. 2 - BACK TRANSFER MODELS

With the starting shaft latched and the machine in home position, there is to be 3/16" minimum clearance between the minus engaging arm and the stud on the gate actuating arm. To adjust, move the control link.

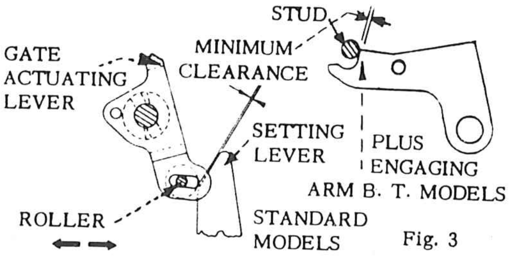
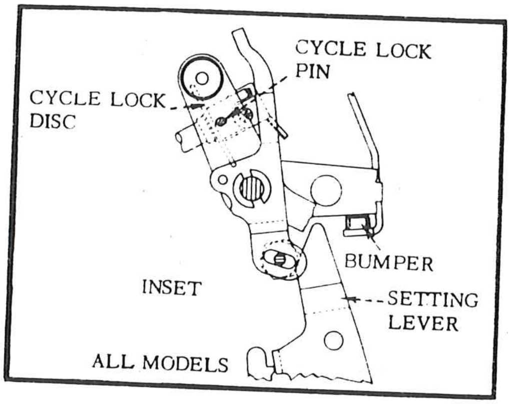


Fig. 3

FIG. 3 - STANDARD AND BACK TRANSFER MODELS

With the minus key depressed and the drive shaft half-cycled, there is to be minimum clearance between the roller on the gate actuating lever and the gate setting lever. To adjust, move the roller.



INSET

ALL MODELS

To check the adjustment, remove the carriage and delatch the gate setting lever. The gate must be actuated rearward far enough to position the cycle lock pin to the rear of the cycle lock disc as shown in the Inset.

NOTE: On back transfer models, the adjustment is the same except that the plus engaging arm must move on and off the stud without binding.

ENTER DIVIDEND

ADJ. 5 - CLUTCH RELEASE BOOSTER

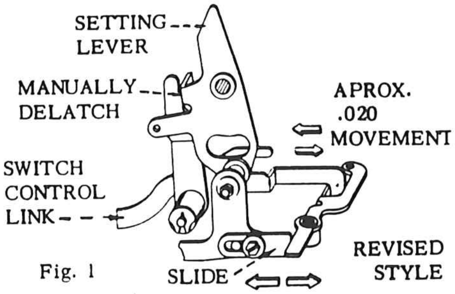


Fig. 1

FIG. 1 - REVISED STYLE

With the machine in home position (keyboard lock key to the rear), manually delatch the setting lever to position the add-subtract gate fully rearward. There is to be approximately .020" movement of the switch control link. To adjust, move the slide.

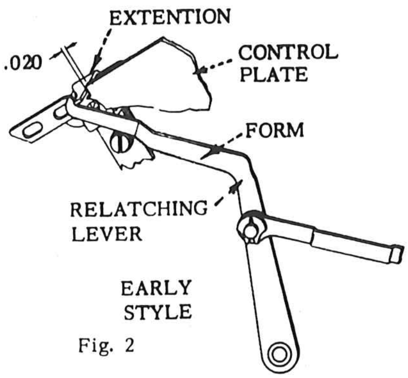
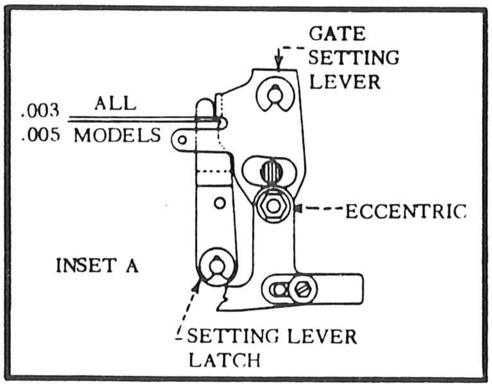


Fig. 2

FIG. 2 - EARLY STYLE

Position the parts in the same manner described in Fig. 1. There is to be approximately .020" clearance between the extension on the shift contact and levers assembly and the notch on the control plate. To adjust, form the relatching lever.

ADJ. 6 - RELATCHING GATE SETTING LEVER



The .003" to .005" overlatch of the gate setting lever to the setting lever latch applies to all model calculators having dividend tabulation. The method of adjustment varies depending upon the model machine. Therefore, it will be necessary to determine the particular adjustment applicable to the machine being worked on.

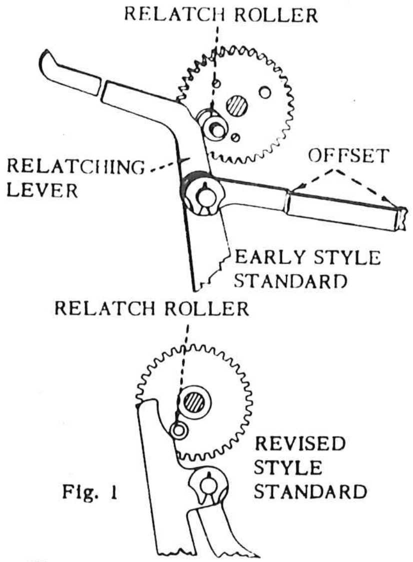


Fig. 1

FIG. 1 - EARLY STYLE (Standard Models)

Position the relatch roller on the high point of movement with the relatching lever as shown. To adjust, form the relatching lever at the offset.

FIG. 1 - REVISED STYLE (Standard Models)

Position the parts in the same manner as described for the early style. To adjust, rotate the eccentric shown in Inset A. Keep the high point of the eccentric down.

Note: On machines that have the auxiliary tab stop located between the "C" and "9" tab stop (Inset B), position the relatch lever roller on the high lobe of the tabulating restore cam. Then rotate the eccentric shown in Inset A.

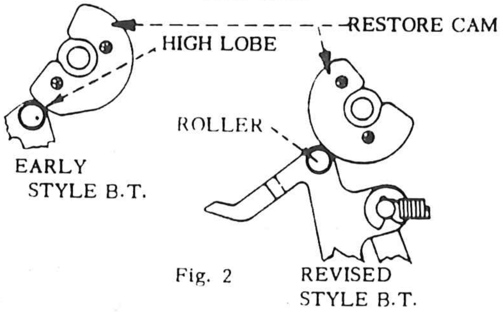


Fig. 2

FIG. 2 - EARLY STYLE

(Back Transfer Models)

When the roller is on the high lobe of the cam, manually trip the setting lever latch. The gate setting lever lip is to drop a few thousandths of an inch behind the setting lever latch as shown in Inset C. This is necessary to insure the tripping of the gate setting lever when the carriage tabulates to the extreme right with no tab stop depressed.

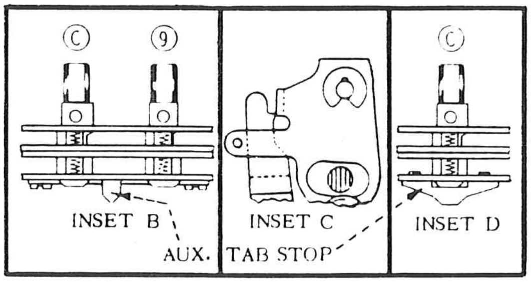
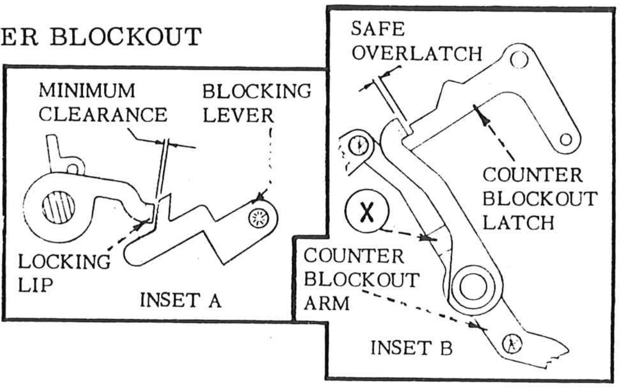


FIG. 2 - REVISED STYLE

(Back Transfer Models)

On machines that have the auxiliary tab stop located in front of the "C" tab stop (Inset D), and also have the revised restore cam; position the cam as shown and then adjust the eccentric shown in Inset A, (Fig. 1, Revised Style).

ADJ. 7 - COUNTER BLOCKOUT



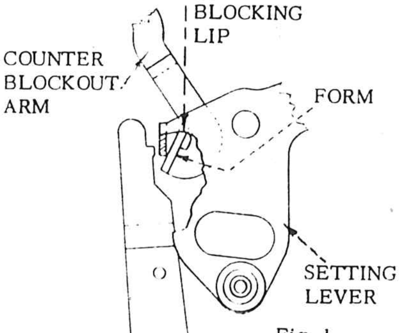


Fig. 1

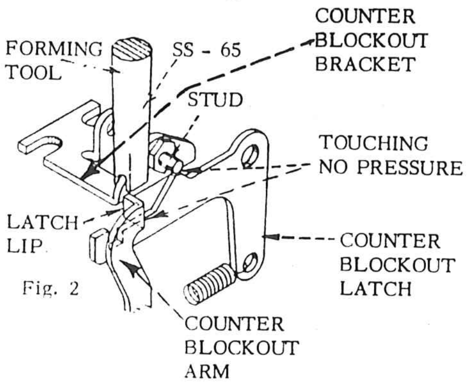


Fig. 2

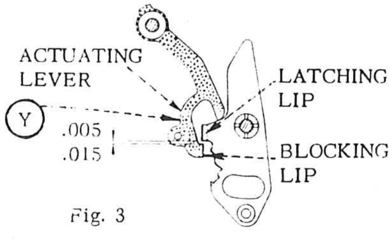


Fig. 3

FIG. 1 - MODELS WITHOUT COUNTER BLOCKOUT LATCH (Inset A)

With the carriage removed and the machine in home position, manually move the add-subtract gate to the plus position and depress the counter locking lip as shown in Inset A. There is to be minimum clearance between the locking lip and the blocking lever. To adjust, form the blocking lip on the counter blockout arm.

FIG. 1 - MODELS WITH COUNTER BLOCKOUT LATCH (Inset B)

With the carriage removed and the machine in home position, trip the setting lever to actuate the add-subtract gate to the plus position. The counter blockout arm is to engage the counter blockout latch with a safe overlatch. To adjust, form the blocking lip on the counter blockout arm. Restore the machine to home position and check the locking lip for minimum clearance as shown in Inset A. Note: On this machine it is sometimes necessary to form the counter blockout arm at point "X" in order to obtain the required clearance.

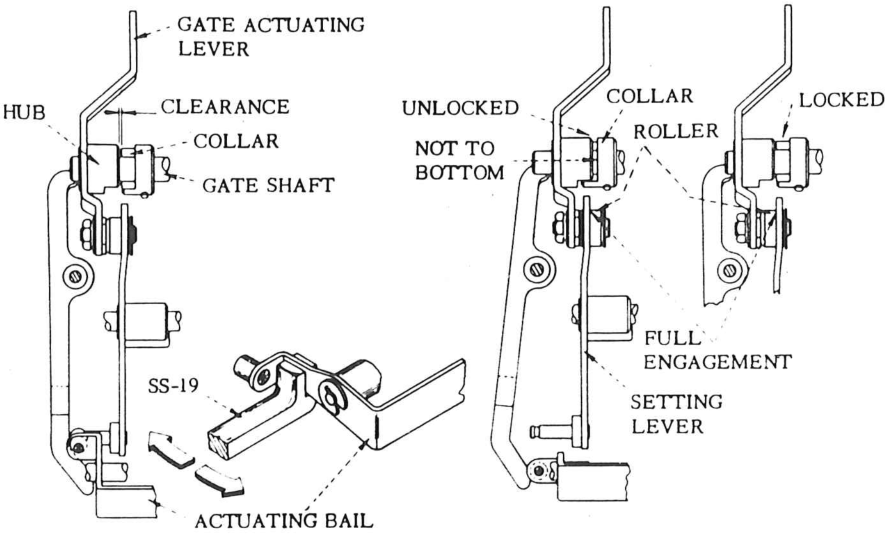
FIG. 2 - MODELS WITH COUNTER BLOCKOUT LATCH

With the add-subtract gate in home position, the stud on the counter blockout bracket is to touch the point on the counter blockout latch, but is not to have pressure against the latch. Also, the latch lip on the counter blockout arm is to touch the blockout latch with no pressure. To adjust, form the bracket to raise or lower the stud.

FIG. 3 - MODELS WITH COUNTER BLOCKING ACTUATING LEVER

When the enter dividend key is depressed, the blocking lip is to clear the latching lip by .005" to .015". To adjust, form the actuating lever at point "Y".

ADJ. 8 - PLUS AND MINUS GATE CONTROL LEVER



ALL MODELS WITH TABULATION

When the keyboard is locked, the splined hub of the gate actuating lever is to be disengaged from the hub on the gate shaft. When the keyboard is unlocked, the splined hub is to engage the hub on the gate shaft, but is not to bottom. To adjust, form the actuating bail. Check to see that the setting lever has full engagement with the roller in both the locked and unlocked positions.

ADJ. 9 - TAB KEY RELEASE LEVER

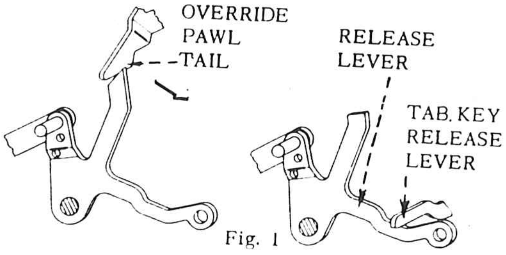


Fig. 1

FIG. 1 - MACHINES WITHOUT A FIXED TAB STOP

With no tab stop depressed, the enter dividend key is to restore when the carriage reaches the extreme right position and the first override occurs. To adjust 2-point shift models, form the tail of the override pawl. To adjust 4-point and smooth shift models, form the tab key release lever.

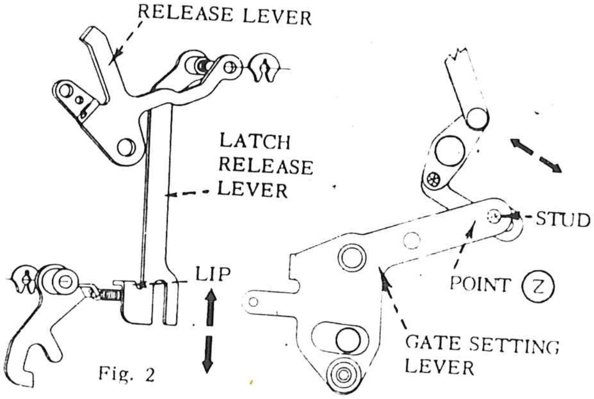


Fig. 2

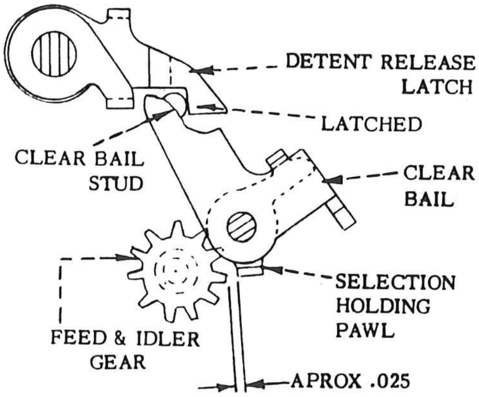
FIG. 2 - ALL MODELS

With a tab stop depressed and the enter dividend key held down, there is to be only one entry into the accumulator dials. To adjust, form the lip on the latch release lever.

NOTE: On back transfer models, the gate setting lever is to relatch after the first subtract cycle in back transfer. It may be necessary to form the gate setting lever at point "Z" to raise or lower the stud.

BACK TRANSFER

ADJ. 1 - CLEARANCE OF FEED & IDLER GEARS TO SELECTION HOLDING PAWLS



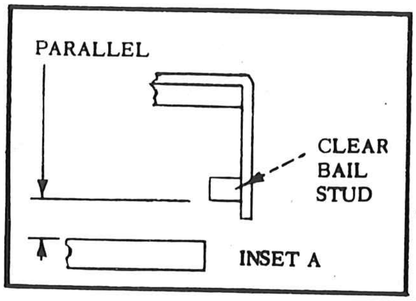
With the clear bail parallel to the unit frame and the clear bail stud latched on the detent release latch, the selection holding pawls are to have approximately .025" clearance to the feed and idler gears. To adjust:

(1) Check to see that the clear bail stud is parallel to the unit frame as shown in Inset A.

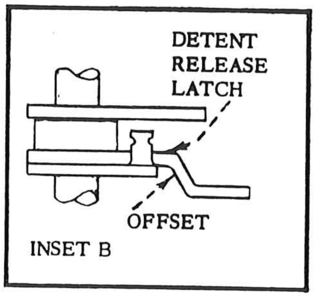
(2) Form the detent release latch at the offset, but keep the end of the latch straight as shown in Inset B.

Note: This adjustment can best be made prior to installing the program unit.

Check KB release linkage if latch fails to relatch



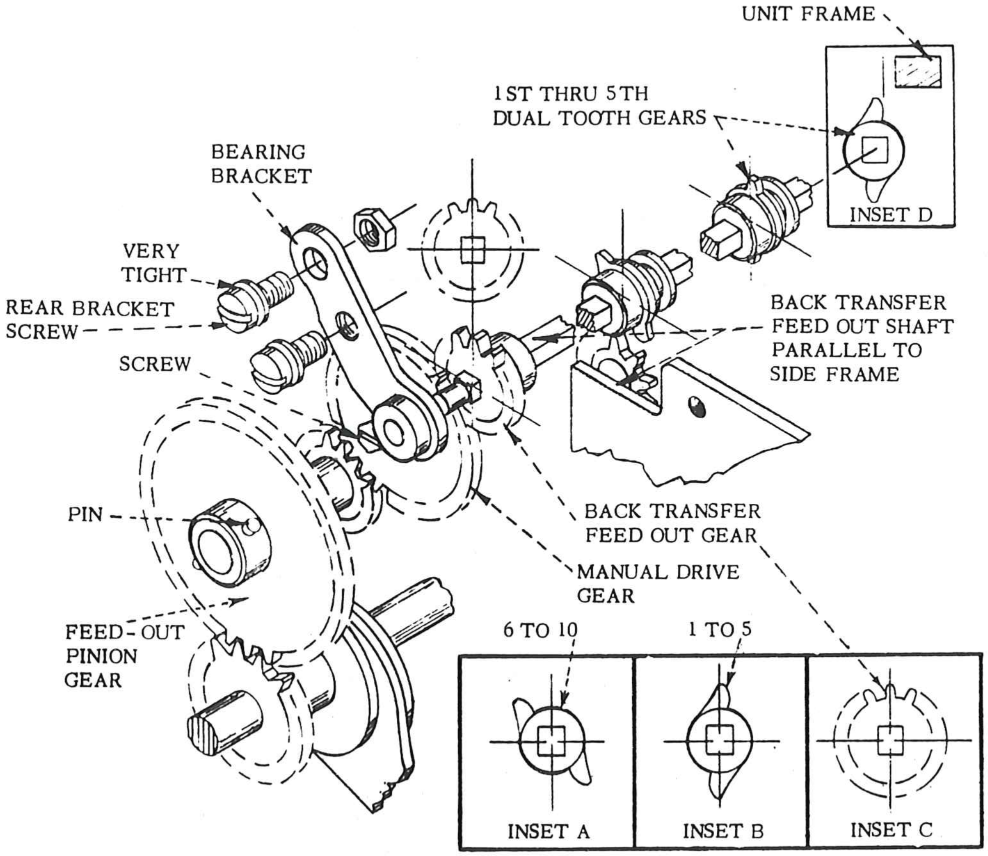
INSET A



INSET B

BACK TRANSFER

ADJ. 2 - TIMING OF FEED OUT SHAFT & DUAL TOOTH FEED GEARS



The 1 to 5 and 6 to 10 dual tooth feed gears and the back transfer feed out gear are to be installed on the back transfer feed out shaft as follows:

(1) Starting from the left the 6 to 10 dual tooth feed gears are to have a tooth aligned with the corner of the shaft as shown in Inset A.

(2) The 1 to 5 dual tooth feed gears are to have a tooth aligned with the flat of the shaft as shown in Inset B.

(3) The back transfer feed-out gear is to be installed with a tooth aligned with the flat of the shaft as shown in Inset C, and aligned with the teeth on the 1 to 5 dual tooth gears.

(4) The flat of the back transfer feed-out shaft is to be parallel to the side frame as indicated in the above illustration. The 1 to 5 dual tooth feed gears are to be parallel to the unit frame as shown in Inset D.

(5) Mesh the back transfer feed-out gear with the manual drive gear and install the snap washer.

(6) Install the bearing bracket so the back transfer feed-out gear is in full mesh with the manual drive gear.

Note: Check to see that the rear screw on the bearing bracket is especially tight to prevent the possibility of the back transfer feed-out gear jumping time.

ADJ. 3 - SELECTING ARMS, YIELDABLE SLIDES & AUXILIARY SLIDES

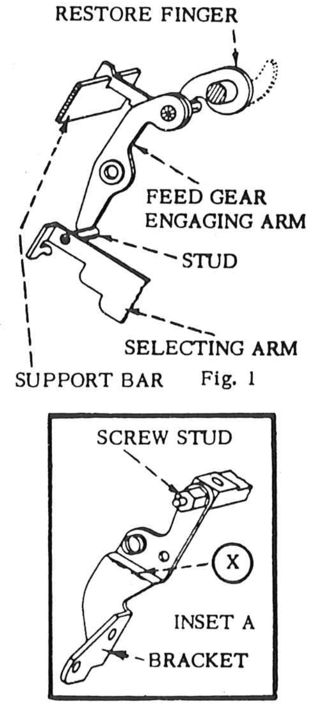


Fig. 1

FIG. 1 - INSTALLING BACK TRANSFER PROGRAM UNIT

Install the back transfer program unit with the lower end of the feed gear engaging arm to the rear of the studs on the 1 to 5 selecting arms. Then shift the unit around until the auxiliary slides are perfectly free, but try to keep the unit as near straight up as possible.

Note: The screw stud shown in Inset A must be kept as tight as possible and whenever it is removed for any reason, it should be discarded and replaced with a new one. Otherwise, there is a good chance that the screw will break off inside the part.

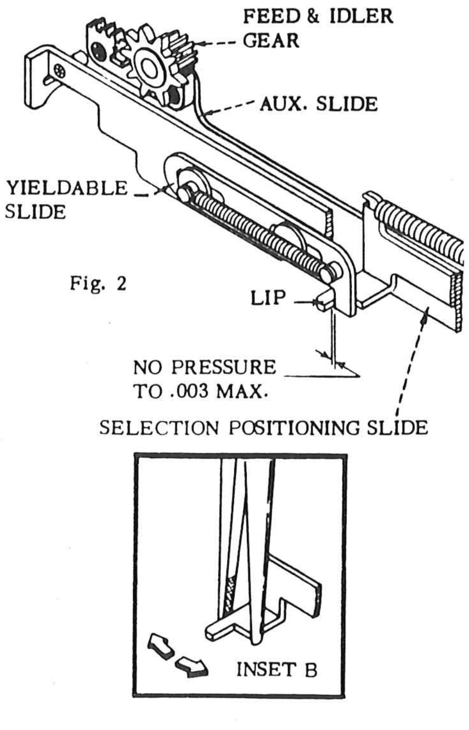


Fig. 2

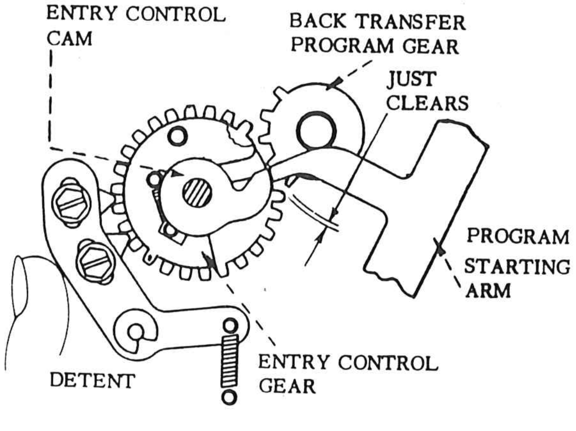
FIG. 2 - CLEARANCE OF YIELDABLE SLIDE TO LIPS ON AUX. SLIDES

The clearance between the Lips on the auxiliary slides and the yieldable slides must be held as close as possible (.000" to .003") but with no pressure. To adjust, form the Lips as shown in Inset B.

CHECK POSITION OF UNIT
AND MESH [illegible]
[illegible]

BACK TRANSFER

ADJ. 4 - TIMING OF ENTRY CONTROL GEAR



With the entry control gear rotated until the entry control cam is aligned with the program starting arm, the back transfer program gear is to just clear the lower teeth on the entry control gear. To adjust, move the detent. Check by applying pressure against the detent while the machine is running under power. The back transfer program gear will drag on the lower teeth with a noticeable noise.

ADJ. 5 - POSITIONING OF TRANSFER BLOCKS & DUAL TOOTH FEED GEARS

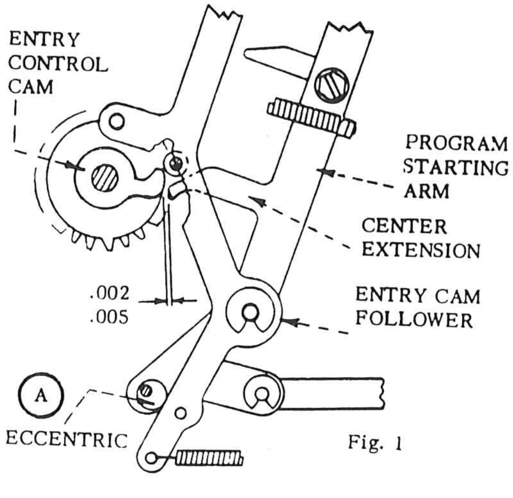


Fig. 1

FIG. 1 - CLEARANCE OF PROGRAM STARTING ARM TO ENTRY CONTROL CAM

With the entry control cam positioned to restore the program starting arm, there is to be .002" to .005" clearance at the closest point between the entry control cam and the center extension. To adjust, turn eccentric "A".

Continued on next page

ADJ. 5 - POSITIONING OF TRANSFER BLOCKS & DUAL TOOTH FEED GEARS

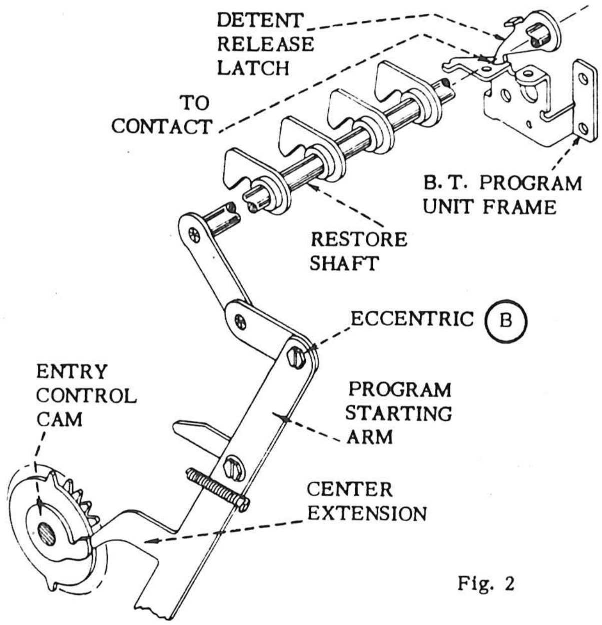


Fig. 2

FIG. 2 - DETENT RELEASE LATCH

With the center extension on the program starting arm aligned with the entry control cam, the detent release latch is to just contact the back transfer program unit frame. To adjust, turn eccentric B as required. After adjusting, check to see that the restore shaft is not bottomed.

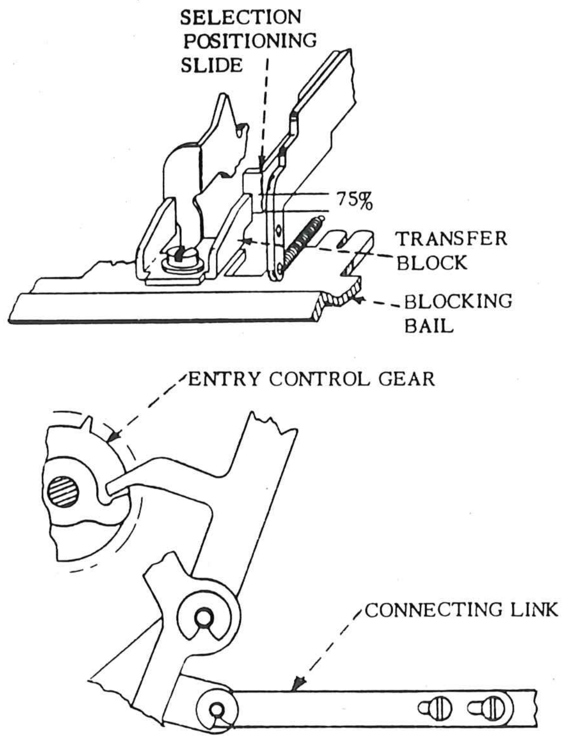
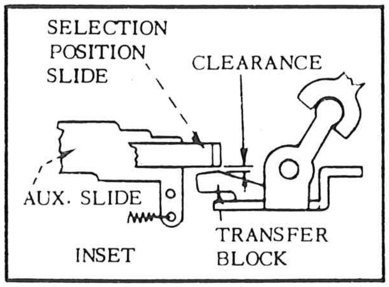


Fig. 3

FIG. 3 - TRANSFER BLOCK ENGAGEMENT

With the entry control gear rotated to the position shown, the transfer block is to engage the selection positioning slide with a 75% bite. To adjust, move the connecting link. After the adjustment is made, rotate the machine to home position, and move the selection positioning slides forward to see that they clear the transfer blocks.



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BACK TRANSFER

ADJ. 5 - POSITIONING OF TRANSFER BLOCKS & DUAL TOOTH FEED GEARS

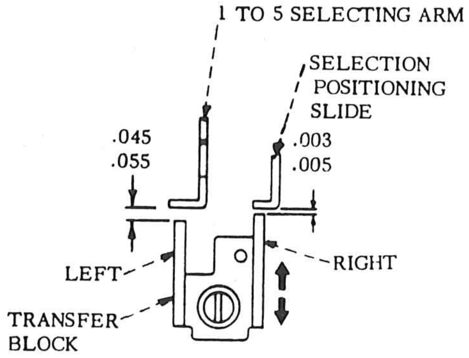


Fig. 4

FIG. 4 - TRANSFER BLOCKS (Engaged Position)

With the transfer blocks raised to the blocking position, there is to be .003" to .005" clearance between the right hand block and its selection positioning slide; and .045" to .055" clearance between the left hand block and its selection positioning slide. To adjust move the transfer blocks.

Set-Up: Have the keyboard out, carriage in, and all dials at zero. Move the entry control gear out of home position to raise the transfer blocks into blocking position.

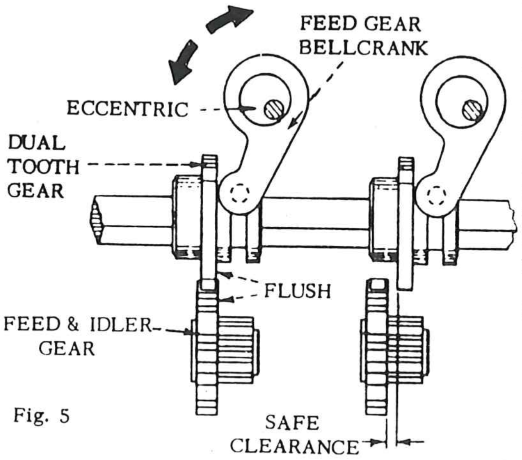


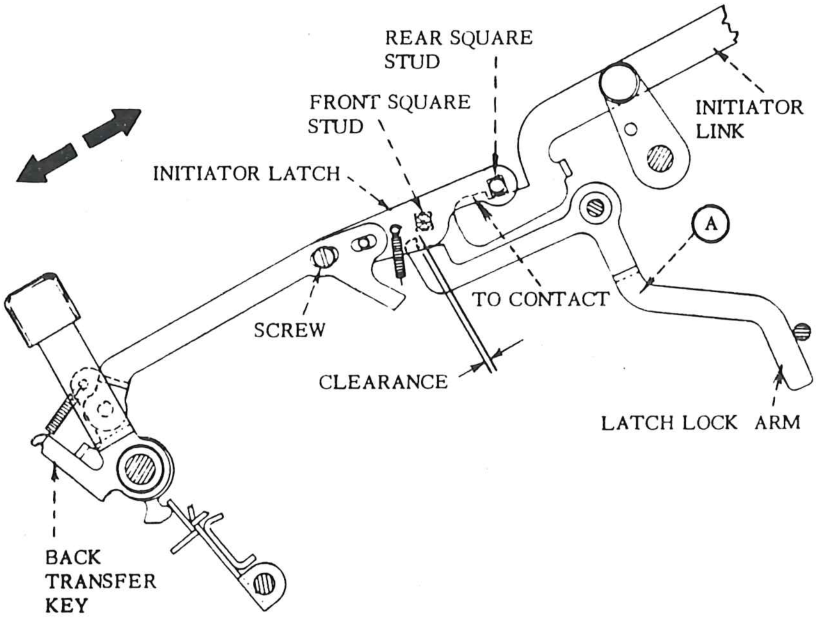
Fig. 5

FIG. 5 - DUAL TOOTH GEAR MESHING

When the dual tooth feed gears are meshed with the feed and idler gears, the right side of each dual tooth feed gear is to be flush with the right side of its feed and idler gear. When the dials are back transferred to zero, the dual tooth feed gears are to disengage from the feed and idler gears with a safe clearance. To adjust, turn each feed gear bellcrank eccentric, keeping the eccentric up and to the left.

Set-Up: Have the keyboard out, the carriage on, 1's in the 1st through 11th dials, and the #1 tab stop down. Depress the starting shaft and cycle the drive shaft by hand crank until the entry control cam moves out of home position and the dual tooth feed gears mesh with the feed and idler gears.

ADJ. 6 - INITIATOR LATCH & LATCH LOCK ARM



(1) With all 1's selected in the main keyboard and the back transfer key pulled slowly forward, the rear square stud on the initiator latch is to contact the lip on the initiator link just as the selecting keys are all restored. To adjust, move the initiator latch.

(2) Depress the plus key. The latch lock arm is to raise and lock the initiator latch. When the machine is cycled to home position, the latch lock arm is to drop under the front square stud without binding. To adjust, form the latch lock arm at point "A".

ADJ. 7 - ADD SUBTRACT GATE STABILIZER & ENTRY GEAR STARTING ARM

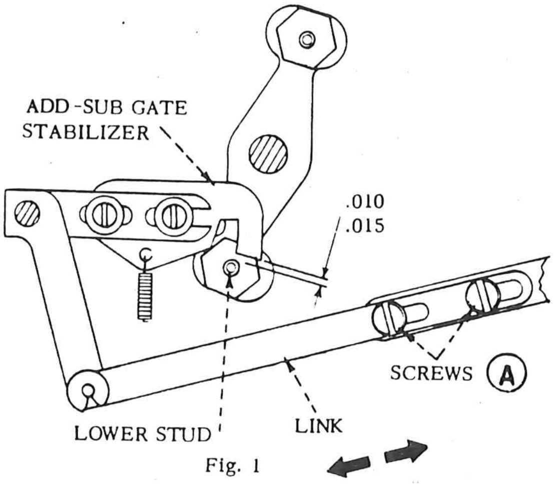


Fig. 1

FIG. 1 - STABILIZER CLEARANCE IN HOME POSITION

With the machine in home position, the carriage off, and the starting shaft latched; there is to be .010" to .015" clearance between the add-subtract gate stabilizer and the lower stud. To adjust, move the link at screws "A".

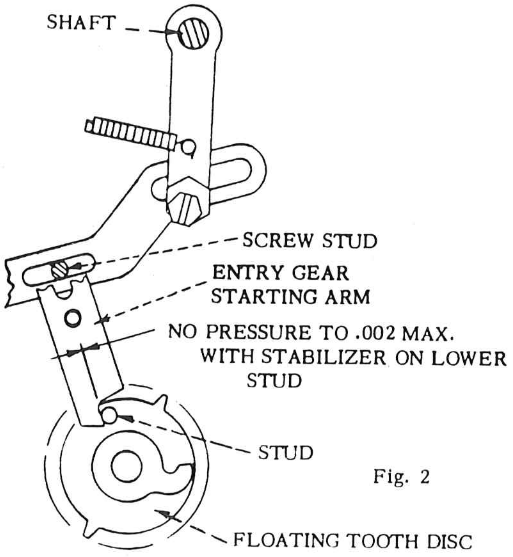


Fig. 2

FIG. 2 - ENTRY GEAR STARTING ARM

With the starting shaft tripped off and the add-subtract gate stabilizer resting on top of the lower stud, the entry control gear starting arm is to have from no pressure to .002" clearance to the stud of the floating tooth disc. To adjust, move the entry gear starting arm at the screw stud.

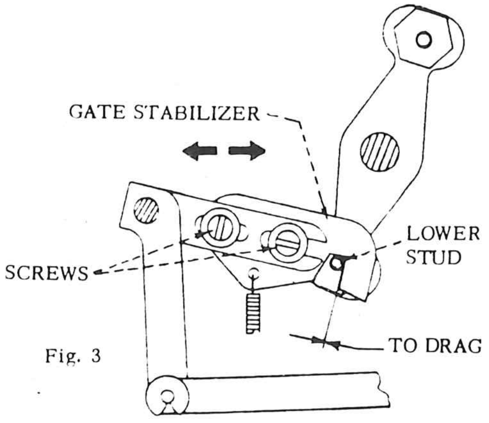


Fig. 3

FIG. 3 - ENGAGED POSITION OF GATE STABILIZER

With the carriage off, and the power off, pull the back transfer key forward. Then manually trip the gate setting lever to position the add-subtract gate to the minus position. As the gate stabilizer drops, it is to engage the lower stud with a slight drag. To adjust, move the gate stabilizer.

ADJ. 8 - RELATCHING OF THE STARTING SHAFT

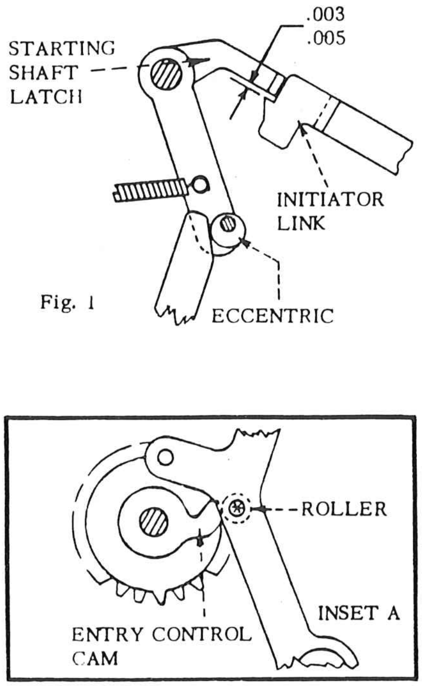


Fig. 1

FIG. 1 - STARTING SHAFT OVERLATCH

With the carriage on, and the #1 tab stop set, operate the machine in back transfer by hand crank until the entry cam follower roller is on the high point of the entry control cam as shown in Inset A. There is to be .003" to .005" overlatch of the starting shaft latch to the initiator link. To adjust, turn the eccentric.

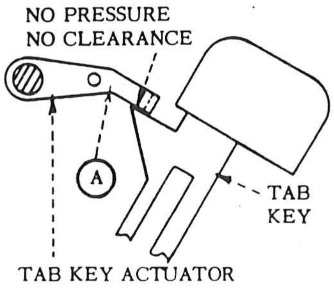


Fig. 2

FIG. 2 - TAB KEY ACTUATOR CLEARANCE

With the machine restored to home position and the starting shaft latched on the initiator link, the tab key actuator is to have no pressure and no clearance to the tab key. To adjust, form the tab key actuator at point "A".

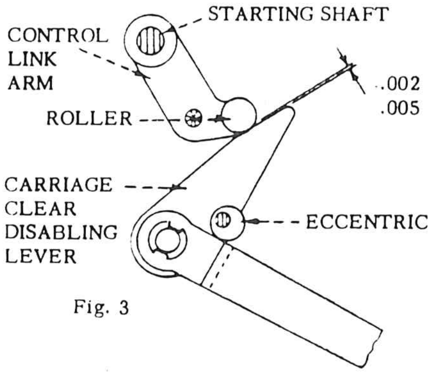


Fig. 3

FIG. 3 - CARRIAGE CLEAR DISABLING LEVER

With the machine in home position and the starting shaft latched, there is to be .002" to .005" clearance between the roller on the control link arm and the carriage clear disabling lever. To adjust, turn the eccentric.

Continued on next page

ADJ. 8 - RELATCHING OF THE STARTING SHAFT

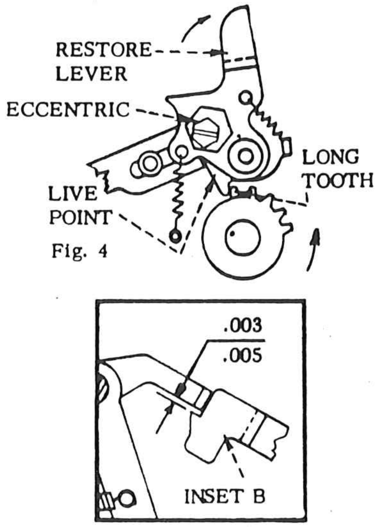


FIG. 4 - RELATCHING OF STARTING SHAFT FROM DIVISION STOP KEY

Manually engage the live point and cycle the drive shaft until the long tooth picks up the live point. Rotate the drive shaft slowly. The long tooth is to retain its engagement with the live point until the starting shaft latch has overlatched the initiator link by .003" to .005". To adjust, turn the eccentric, keeping the high side facing up.

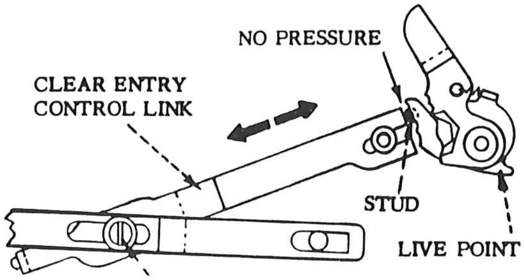


FIG. 5 - CLEAR ENTRY CONTROL LINK

With the machine [illegible] position, the clear entry [illegible] link is to be as close as [illegible] the stud on the live point [illegible] touching. To adjust, move [illegible] clear entry control link.

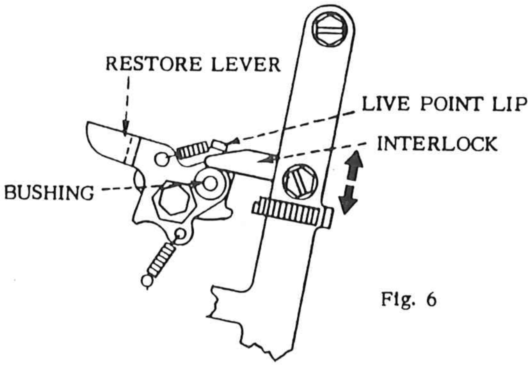
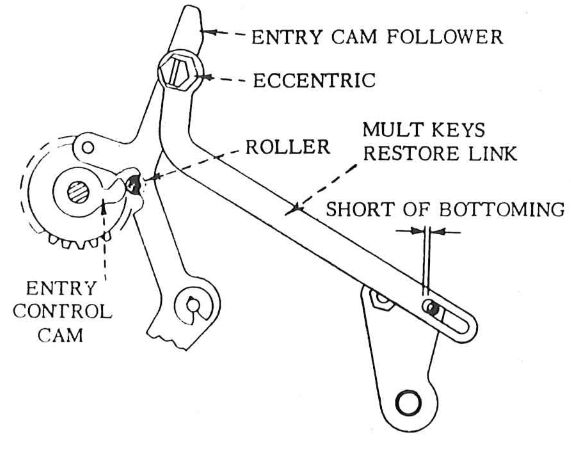


FIG. 6 - RESTORE LEVER BLOCKOUT

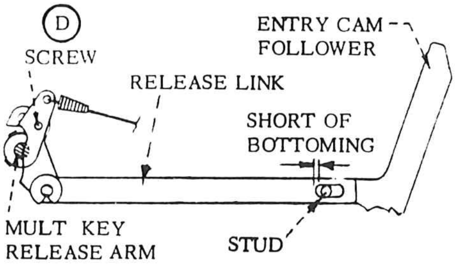
With the machine manually cycled in back transfer, the interlock is to be positioned between the live point lip and the bushing. To adjust, move the interlock. After adjusting, check to see that the live point does not contact the back transfer program gear when the division stop key is pushed to the rear.

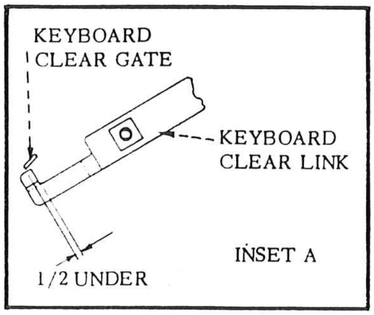
ADJ. 9 - MULT KEY RESTORE LINK



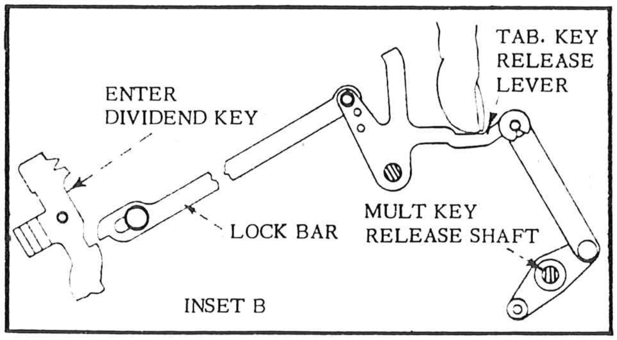
With the machine manually cycled in back transfer until the entry cam follower roller is on the high point of the entry control cam, the mult keys restore link is to be just short of bottoming on the stud of the clutch opening lever. To adjust, turn the eccentric.

ADJ. 10 - TIMING OF ENTER DIVIDEND KEY RELEASE





INSET A



INSET B

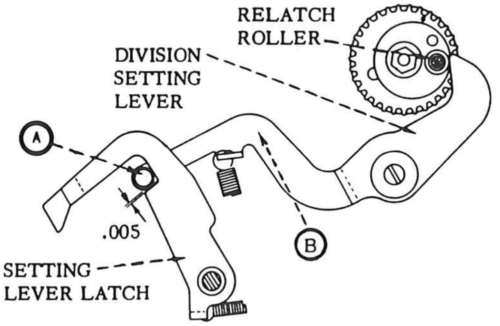
In back transfer (add key forward and tab stop set), the enter dividend key is to release when the entry cam follower roller is riding up the entry control cam and the last rearward movement of the keyboard clear link has positioned the clear link approximately half way under the lip of the keyboard clear gate as shown in Inset A.

To adjust, have the machine in home position and depress the tab key release lever per Inset B. Then loosen screw D and move the mult key release shaft arm so the slot in the release link is just short of bottoming against the stud on the entry control cam follower.

Note: After making this adjustment, recheck Adj. 8, Fig. 5.

DIVISION

ADJ. 1 - RELATCHING OF DIVISION SETTING LEVER



With the division setting lever at its high point of movement with the relatch roller, the roller A is to overlatch the setting lever latch by .005". To adjust, form the division setting lever at point "B".

ADJ. 2 - DIVISION THROWOUT CONNECTOR ARM & THROWOUT ACTUATOR

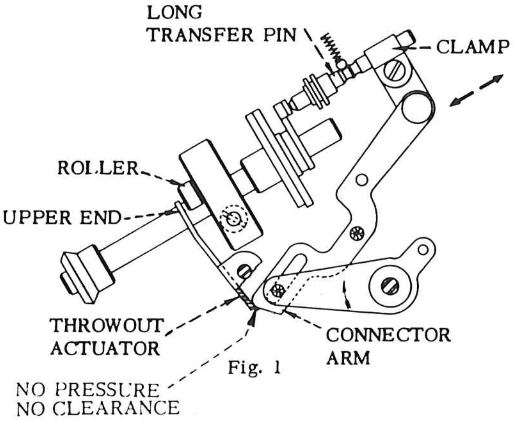


Fig. 1

FIG. 1 - CONNECTOR ARM CLEARANCE TO THROWOUT ACTUATOR

With the long transfer pin detented to its rearward position, rotate the connector arm into position over the throwout actuator. The connector arm is to have no pressure and no clearance to the throwout actuator. To adjust, move the clamp on the long transfer pin.

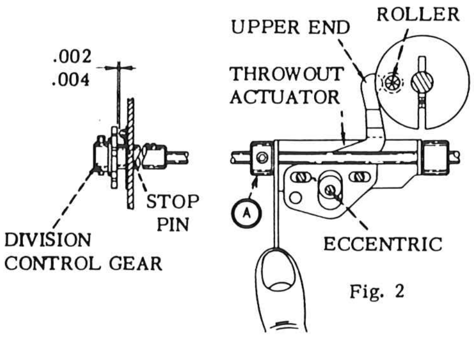


Fig. 2

FIG. 2 - DIVISION CONTROL GEAR CLEARANCE TO STOP PIN (Revised Style)

(1) When the roller on the throwout cam has moved the throwout actuator to it maximum throw, the division control gear is to clear the stop pin by .002" to .004". To adjust, turn the eccentric.

(2) The throwout actuator is to have a minimum amount of end play and yet be free to rotate. To adjust, move collar A.

Continued on next page

ADJ. 2 - DIVISION THROWOUT CONNECTOR ARM & THROWOUT ACTUATOR

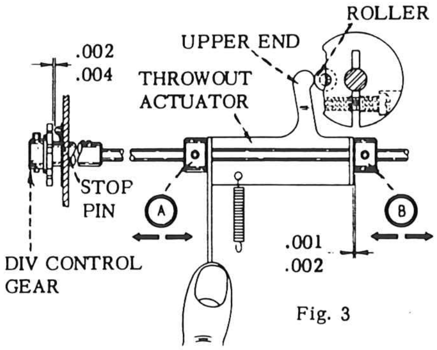


Fig. 3

FIG. 3 - DIVISION CONTROL GEAR CLEARANCE TO STOP PIN (Early Style)

(1) When the roller on the throwout cam has moved the throwout actuator to its maximum throw, the division control gear is to clear the stop pin by .002" to .004". To adjust, have collar B loose and move the collar A as required.

(2) The throwout actuator is to have a minimum amount of end play and yet be free to rotate. To adjust, move collar B.

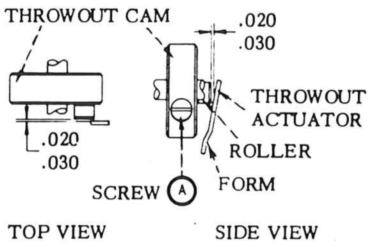


Fig. 4

FIG. 4 - DIVISION THROWOUT CAM CLEARANCE TO THROWOUT ACTUATOR

With the long transfer pin detented to its rearward position (throwout actuator in its unoperated position), and the throwout cam roller rotated to its closest position behind the throwout actuator, there is to be .020" to .030" clearance between the roller and the upper end of the throwout actuator. To adjust: Revised Style --- form the upper end of the throwout actuator. Early Style --- raise or lower the throwout cam.

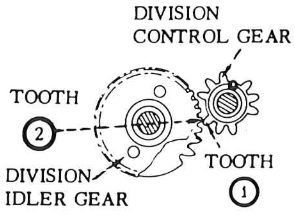


Fig. 5

FIG. 5 - TIMING OF DIVISION CONTROL GEAR

Just as the division control gear starts to move out, tooth "1" on the division control gear is to be in line with tooth "2" on the division idler gear. To adjust: Revised Style --- No adjustment provided; however, the time of moving out can be controlled slightly by the throwout actuator eccentric shown in Fig. 2. Early Style --- Rotate the throwout cam as shown in Fig. 4.

ADJ. 3 - DIVISION CONTROL GEAR AND ADD-SUBTRACT GATE

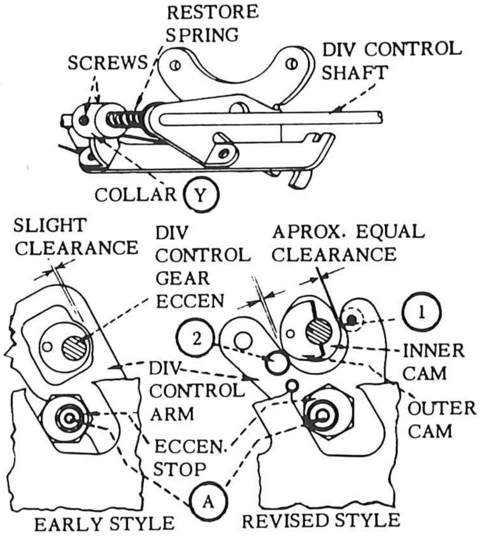


Fig. 1

FIG. 1 - FREE MOVEMENT OF DIVISION CONTROL GEAR

The division control gear is to be perfectly free to move in and out over the stop pin. To adjust:

(1) The return spring on the division control shaft is to be adjusted for proper tension. With the division control gear rotated out of home position, move collar Y to compress the spring enough to close up the coils, but not overcompressed.

(2) Cycle the machine in division until the add-subtract gate is moved to the minus position (division control gear in home position). On machines with the revised style division control arms, there is to be equal clearance between rollers 1 and 2 and the inner and outer cams. On machines with the early style division control arms, there is to be clearance between the division control gear eccentric and the division control arm. For either style, move the eccentric stop "A" to adjust.

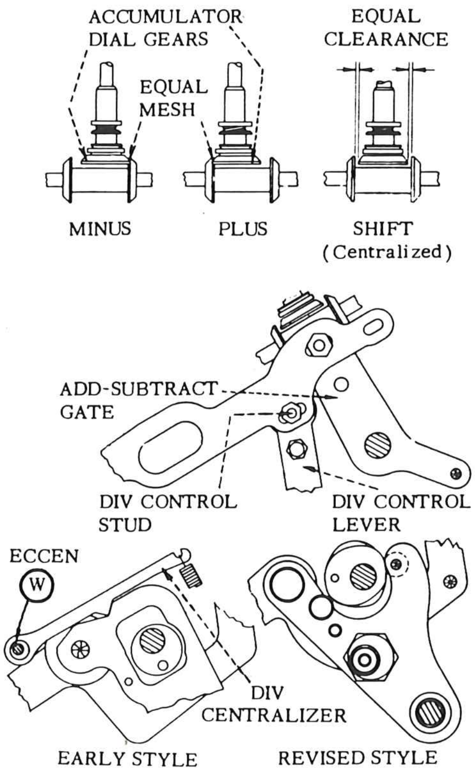


Fig. 2

FIG. 2 - GATE ENGAGEMENT AND NEUTRAL CLEARANCE

With the machine cycled in division, the add-subtract gears are to engage the accumulator dial gears with equal mesh in both add and subtract position. When the carriage is shifting, the add-subtract gears are to have equal clearance to the accumulator dial gears. Also the cycle lock pin is to be free to move in and out without hanging up on the cycle lock disc. To adjust:

Machines with the revised style division control arms, move the directional control slide at the division control stud to obtain equal CLEARANCE on division shift. No adjustment is provided for equal mesh, but this is to be checked.

Machines with the early style division control arms, first move the directional control slide at the division control stud to obtain equal ENGAGEMENT of the add-subtract gears to the dial gears. Then to obtain equal clearance on division shift, turn the eccentric "W" on the division centralizer.

NOTE: As the machine shuts off in division there is to be no movement of the add-subtract gate as the division control lever drops. If there is any movement, it will be necessary to readjust the neutral clearance as stated above. It may also be necessary to readjust the carriage and gate setting adjustments.

ADJ. 4 - CARRIAGE SHIFT

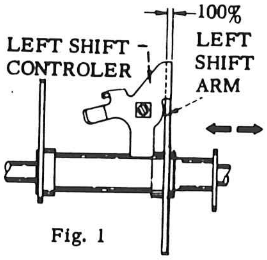
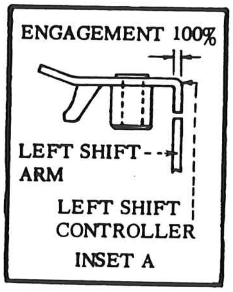


Fig. 1



INSET A

FIG. 1 - ENGAGEMENT OF LEFT SHIFT ARM

With the machine in home position, the left shift arm is to engage the left shift controller with a 100% bite as shown in Inset A. To adjust, form the left shift arm.

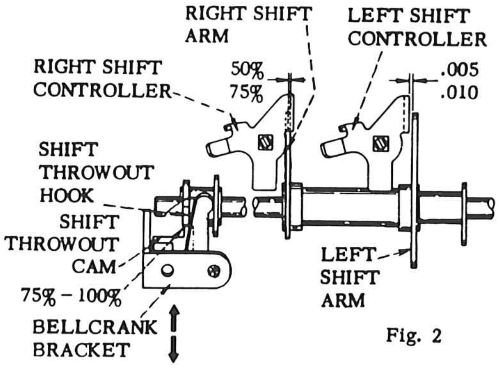
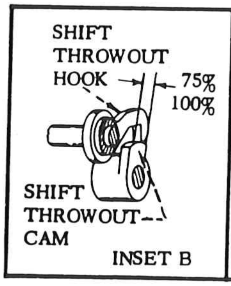
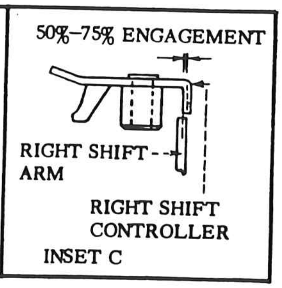


Fig. 2



INSET B



INSET C

FIG. 2 - ENGAGEMENT OF RIGHT SHIFT ARM

With the carriage clear, manually cycle the machine in division until the 2nd right shift has caused the right shift arm to engage and actuate the right shift controller (auxiliary latch and lower aligner latch delatched). Then check and adjust as follows:

1. The left shift arm is to clear the left shift controller by [redacted] to .010". Also, the shift throwout cam is to engage the shift throwout hook with a 75% to 100% bite (Inset B). To adjust, form the bellcrank bracket up or down as required.

2. The right shift arm is to engage the right shift controller with a 50% to 75% bite (Inset C). To adjust, form the right shift arm.

Continued on next page

ADJ. 4 - CARRIAGE SHIFT

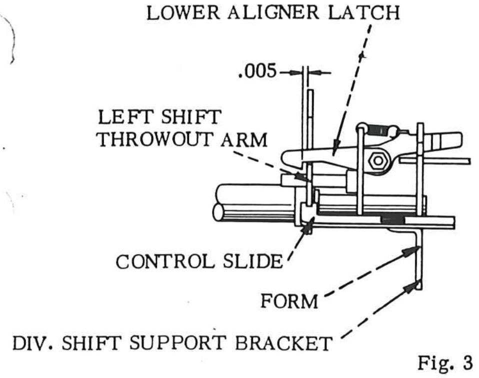


Fig. 3

FIG. 3 - HOME CLEARANCE OF LOWER ALIGNER LATCH

With the machine in home position, there is to be .005" clearance between the lower aligner latch and its latching point on the left shift throwout arm. To adjust, form the division shift support bracket at point shown.

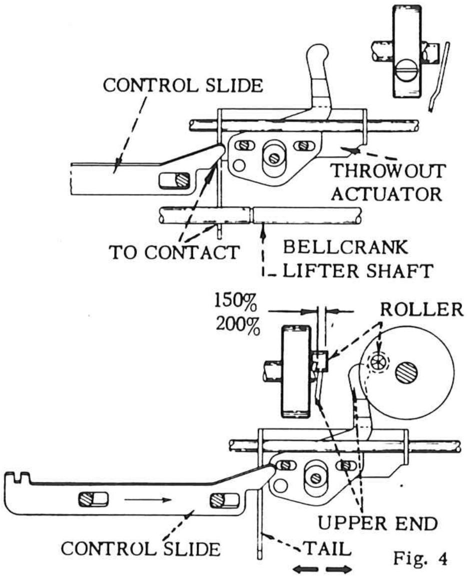


Fig. 4

FIG. 4 - ENGAGEMENT AND DISENGAGEMENT OF THROWOUT ACTUATOR

(1) With the machine in home position, the upper end of the throwout actuator is to clear the roller on the throwout cam and the tail is to contact the control slide and the bellcrank lifter shaft as shown.

(2) With the machine cycled in division until the lower latch is delatched and the division control gear is in home position, the control slide is to hold the upper end of the throwout actuator engaged on the throwout cam roller with a 150% to 200% bite.

To adjust, form the throwout actuator tail.

ADJ. 5 - DIVISION ALIGNMENT

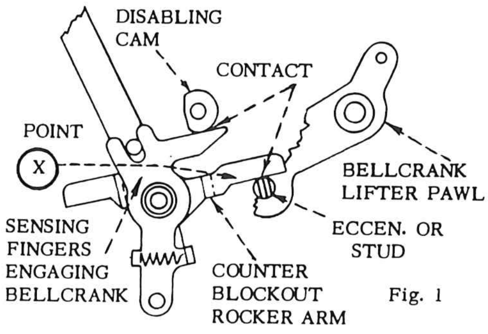

DISABLING CAM
CONTACT
POINT
X
BELLCRANK LIFTER PAWL
SENSING FINGERS ENGAGING BELLCRANK
ECCEN. OR STUD
COUNTER BLOCKOUT ROCKER ARM

Fig. 1

FIG. 1 - BELLCRANK LIFTER PAWL

With the machine in home position and the division control gear restored over its stop pin, the sensing fingers engaging bellcrank is to contact the disabling cam; and the eccentric stud on the bellcrank lifter pawl is to contact the counter blockout rocker arm. To adjust:

Models with eccentric stud, turn the eccentric.

Models without eccentric stud, form the counter blockout rocker arm at point X.

Continued on next page

ADJ. 5 - DIVISION ALIGNMENT

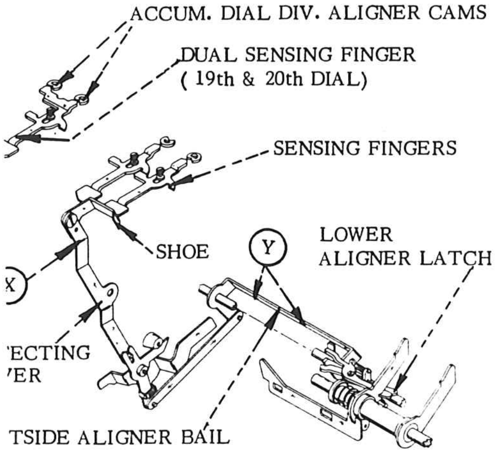


Fig. 2

FIG. 2 - DELATCHING OF THE LOWER ALIGNER LATCH

1. With the machine in home position, the outside aligner bail is to have no pressure against the lower aligner latch and cause it to be partially delatched. To adjust, form the detecting lever at point X.
2. With a "5" turned in the 18th accumulator dial and a figure selected in the 10th column of the main keyboard, cycle the machine under power in division. As the carriage shifts to the right in division alignment, the detecting lever is to move in and delatch the lower aligner latch just as the shoe on the detecting lever aligns with the 19th dial. To adjust, form the outside aligner bail at point Y.

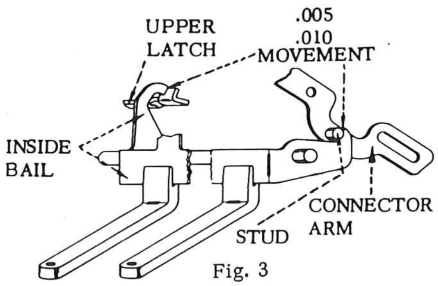


Fig. 3

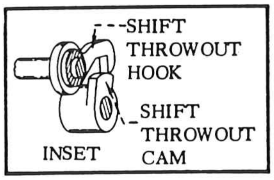


FIG. 3 - INSIDE BAIL

With the carriage and the keyboard clear, manually cycle the machine in division until the shift throwout hook is positioned on the shift throwout cam as shown in the inset. In this position, the inside bail is to have .005" to .010" movement between the upper latch and the stud on the connector arm. To adjust, form the inside bail as required.

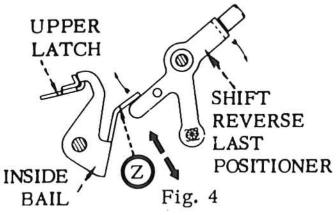


Fig. 4

FIG. 4 - SHIFT REVERSE LAST POSITIONER

(1) With the machine in home position, the shift reverse last positioner is not to hold the inside bail rotated.

(2) With the carriage and the keyboard clear, manually cycle the machine in division until the carriage has shifted to the extreme right. At this point the shift gear is to actuate the override pawl and the inside bail is to unlatch the upper latch. To adjust, form the inside bail at point "Z".

ADJ. 6 - DIVISION STOP

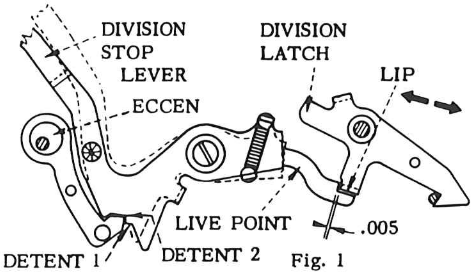


Fig. 1

FIG. 1 - DIVISION STOP LEVER DETENT

(1) The division stop lever is to detent fully into either of the two detent positions designated as detent 1 and detent 2. To adjust, turn the eccentric as required, but keep the high point up and to the rear.

(2) With the division stop lever moved forward into detent 2, cycle the machine in division until the division control lever (Fig. 2) is moved to the add position. The live point is to latch on the lip of the division latch and have .005" clearance to the lip. To adjust, form the latch lip.

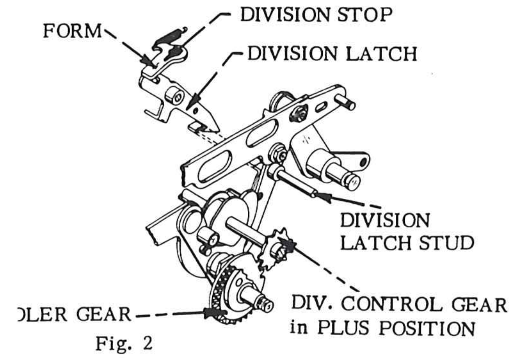


Fig. 2

FIG. 2 - DIVISION STOP ON CARRIAGE

Cycle the machine in division until the carriage reaches the 1st position and the division stop on the carriage moves behind the division latch. The machine is to stop just as the add-subtract gate moves to [redacted] position and before the division control gear reaches home. To adjust, form the division stop up or down as required. SH

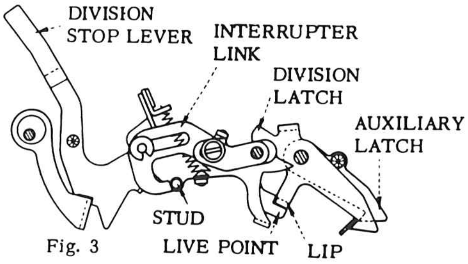


Fig. 3

FIG. 3 - AUTOMATIC DIVISION STOP FROM TAB STOP

With two adjacent tab stops depressed and the carriage shifting left in a division operation, the division operation is to automatically stop when the right hand tab stop contacts the tabulator actuating lever. To adjust, move the interrupter link forward or rearward as required, but not so much that there will be excessive pressure on the parts.

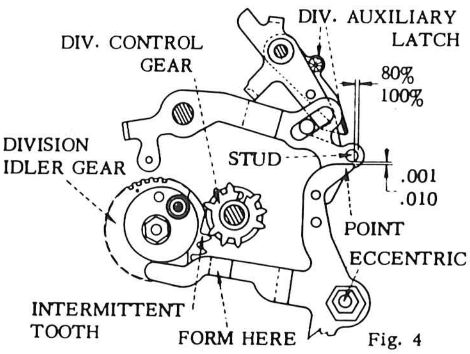


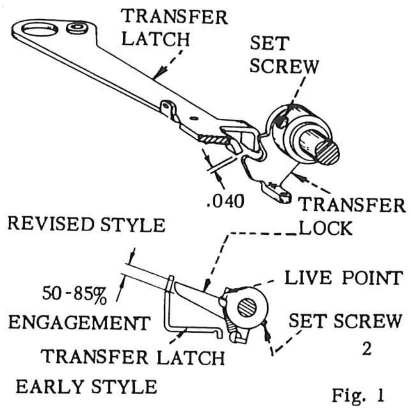
Fig. 4

FIG. 4 - DIVISION RELEASE DELAY ARM

With the keyboard clear, manually cycle the machine in division for three cycles. This will deltach the auxiliary latch and position the add-subtract gate to the subtract position. Continue to cycle the machine until the division control gear starts to move out. Then, just as the first intermittent tooth on the division idler gear contacts the division control gear, there is to be .001" to .010" clearance between the point and the stud, as well as an 80% to 100% engagement. To adjust, turn the eccentric to the rear and down. It may be necessary to form the delay arm for the proper engagement.

SELECTIVE TRANSFER

ADJ. 1 - TRANSFER LOCK (All Models)



REVISED STYLE

EARLY STYLE

Fig. 1

FIG. 1 - TRANSFER LOCK ENGAGEMENT

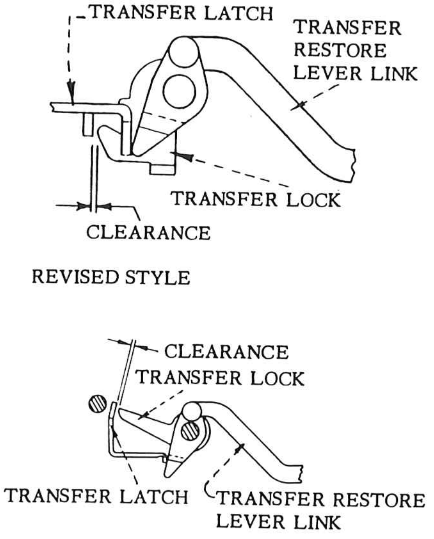
(Revised Style)

When the selective transfer keys are depressed, the tip of the transfer lock is to have approximately .040" clearance to the underside of the transfer latch. To adjust, rotate the transfer lock. With the machine restored to home position, check to see that the transfer latch is blocked by the transfer lock tip.

FIG. 1 - TRANSFER LOCK ENGAGEMENT

(Early Style)

With the machine in home position, the transfer lock is to engage the transfer latch with a 50% to 85% bite. To adjust, rotate the transfer lock.



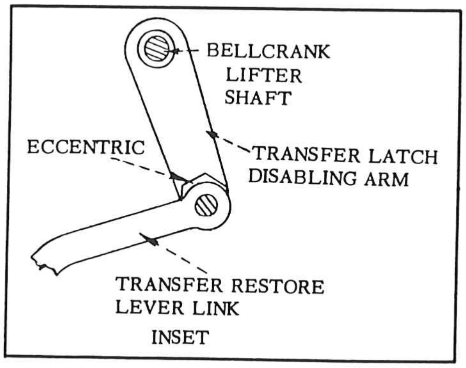
REVISED STYLE

EARLY STYLE

Fig. 2

FIG. 2 - TRANSFER LOCK CLEARANCE TO TRANSFER LATCH

With the machine in home position, the transfer lock is to clear the transfer latch just enough to insure safe engagement and disengagement without catching the transfer latch. To adjust, turn the eccentric on the transfer latch disabling arm as shown in the Inset.



INSET

ADJ. 2 - TRANSFER POSITIONER

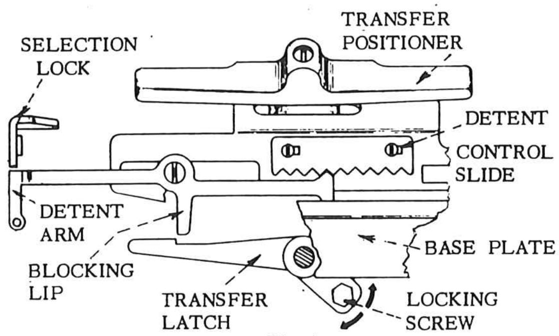


Fig. 1

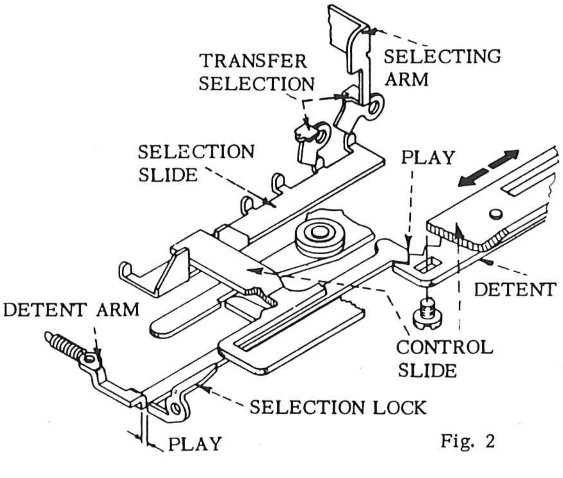


Fig. 2

FIG. 1 - BLOCKOUT

During a selective transfer operation, the transfer positioner must be blocked (even though the selection lock is depressed) by the transfer latch engaging the blocking lip on the detent arm. Also when the machine restores to home position after the selective transfer operation, the transfer latch must disengage the blocking lip with a safe clearance. To adjust: (1) Depress the selective transfer keys and move the transfer latch for maximum engagement with the blocking lip. Then while depressing the selection lock, try to move the transfer positioner. It must be blocked. (2) Next restore the machine to home position. Then depress the selection lock and slide the transfer positioner through all positions. If it is difficult to move, the transfer latch must be re-adjusted to provide clearance between the blocking lip and the transfer latch.

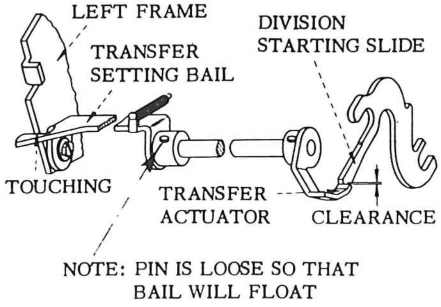
FIG. 2 - POSITIONING OF TRANSFER SELECTION SLIDE

(1) When the control slide is moved to one of the nine detent positions, only one transfer selection finger is to move behind the selecting arm. To adjust, loosen the detent and move the control slide.

To check, move the control slide to the extreme right. The detent arm is to be in the left detent notch and the right transfer selection finger is to be positioned behind the second column selecting arm.

(2) When the detent arm is fully detented in one of the detent notches, there is to be a slight amount of play between the selection lock and the detent arm. To adjust, form the detent arm.

ADJ. 3 - TRANSFER ACTUATOR CLEARANCE TO DIVISION STARTING SLIDE



NOTE: PIN IS LOOSE SO THAT BAIL WILL FLOAT

With the machine in home position and the transfer setting bail touching the left frame, there is to be clearance between the division starting slide and the transfer actuator. To adjust, form the transfer actuator.

Note: The transfer setting bail is pinned to the shaft with a special type pin to give the bail a floating action for alignment purposes.

ADJ. 4 - SELECTING GEAR ENGAGEMENT TO ACTUATORS

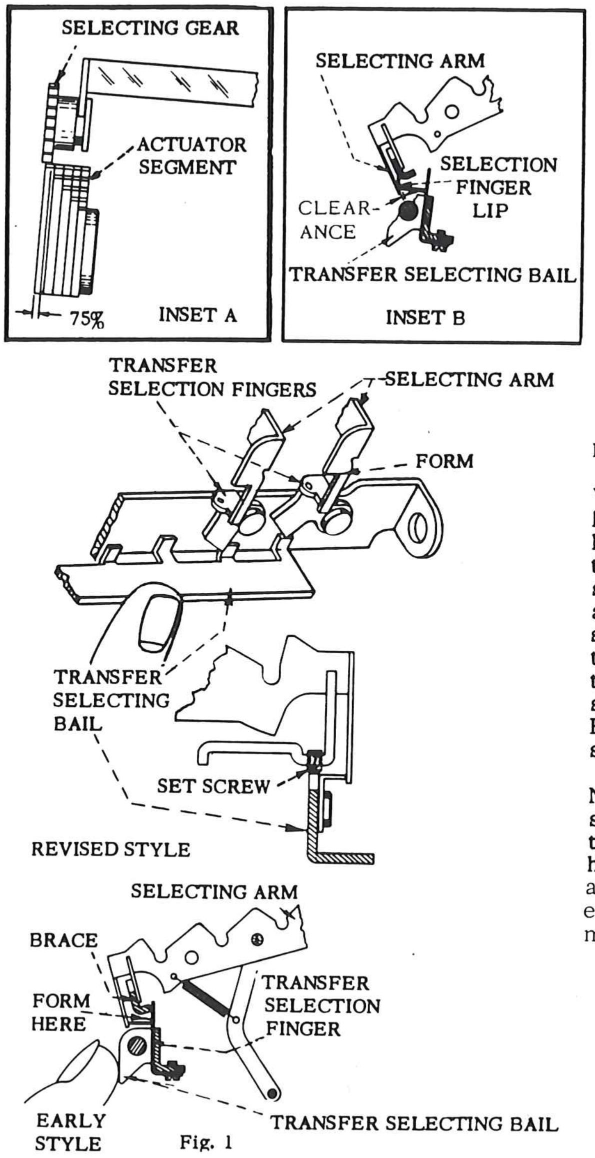


Fig. 1

FIG. 1 - REVISED AND EARLY STYLE

With a selecting arm pulled forward by action of the transfer selecting bail, there is to be 75% engagement of the selecting gear with the actuator segment as shown in Inset A. To adjust: Revised Style --- turn the set screw to obtain the engagement for the one selecting arm. Then adjust the remaining orders by forming the selecting arms at the point indicated. Early Style --- Form the transfer selection fingers at point indicated.

Note: With all the selecting arms restored to home position, check to see that the transfer selection fingers have clearance behind the selecting arms (Inset B). If not, it will be necessary to remake the entire adjustment.

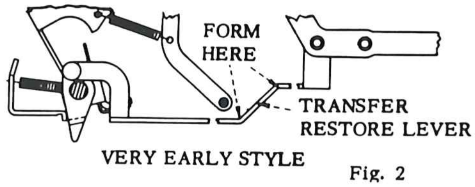


Fig. 2

FIG. 2 - VERY EARLY STYLE

When the transfer keys are depressed and the drive shaft rotated 1/4 cycle, the selecting gear is to have 75% engagement with the #1 segment on the actuator. To adjust, form the transfer restore lever at the offset.

MULTIPLICATION

ADJ. 1 - TIMING

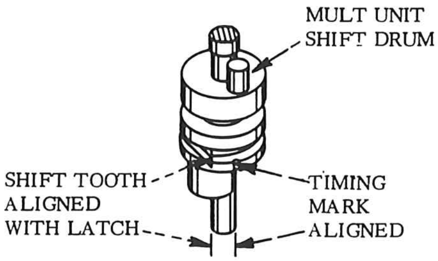
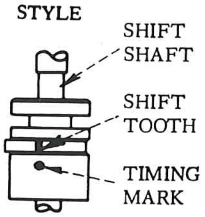


FIG. 1 - MULT UNIT SHIFT TOOTH (Revised Style)

With the drive shaft in home position, the shift tooth is to be aligned with the left side of the shift shaft; and the timing mark is to be aligned with the right side of the shaft. To time, loosen the upper bearing support bracket and disengage the miter gear. Then rotate the shift shaft until the shift tooth and the timing mark are positioned as shown.

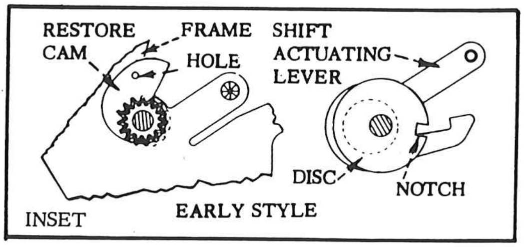
EARLY STYLE



FRONT VIEW Fig. 1

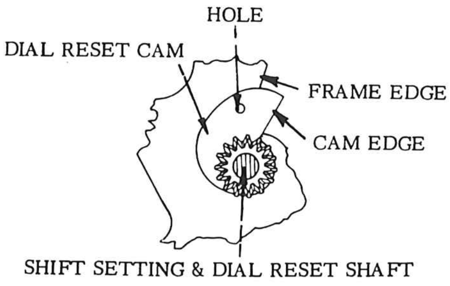
FIG. 1 - MULT UNIT SHIFT TOOTH (Early Style)

With the drive shaft in home position, both the shift tooth and the timing mark are to be aligned with the left side of the shaft. To time, loosen the upper bearing support bracket and disengage the miter gear. Then rotate the shift shaft until the shift tooth and the timing mark are aligned as indicated.



INSET - SHIFT SETTING AND DIAL RESET SHAFT (Early Style)

With the drive shaft in home position, the timing hole in the restore cam is to be centered with the edge of the frame. Also, the notch in the disc is to be aligned with the upper arm of the shift actuating lever. To time, disengage the restore cam drive gear and rotate the restore cam to the position indicated.



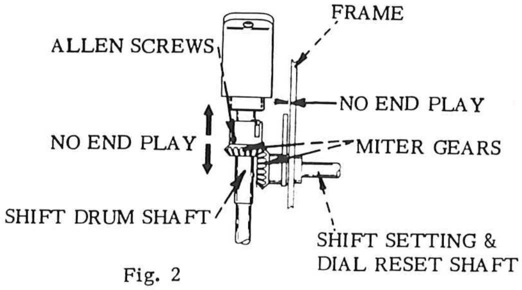


Fig. 2

FIG. 2 - SHIFT SETTING AND DIAL RESET SHAFT

With the drive shaft in home position, the dial reset cam is to be timed so the frame edge is centered between the timing hole and the cam edge. Also, there is to be NO END PLAY in either the shift drum shaft or the shift setting and dial reset shaft. To time and adjust, engage the miter gear on the shift setting and dial reset shaft with the miter gear on the shift drum shaft as shown.

MULTIPLICATION

ADJ. 2 - ALIGNMENT OF UNIT

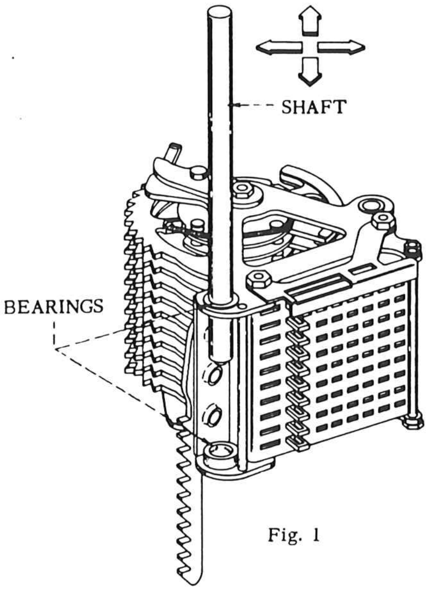


Fig. 1

FIG. 1 - MULT UNIT BEARINGS

Before installing the mult unit align the unit shaft bearings. To adjust use the shaft as a lever and form the bearings. When properly aligned the shaft will drop through both bearings without binding.

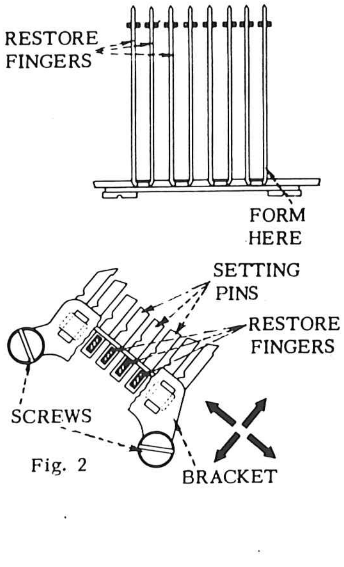


Fig. 2

FIG. 2 - RESTORE FINGERS

The restore fingers are to be aligned with the holes in the setting pins so the unit can be moved from right to left with little or no rubbing on the restore fingers. To adjust, loosen the holding screws just enough to allow slippage; then tap the bracket until the best position is found. In some cases it may be necessary to form the individual fingers to obtain the desired freeness.

MULTIPLICATION

ADJ. 3 - SETTING PIN ALIGNMENT AND UNIT SHIFT

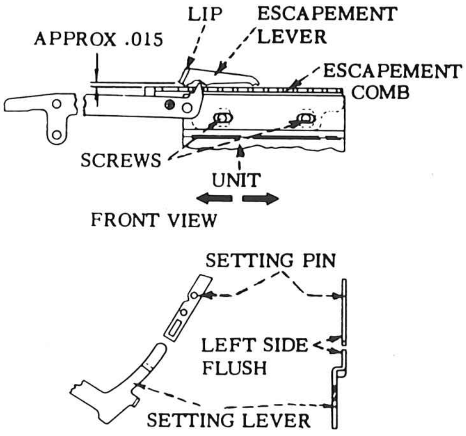


Fig. 1

FIG. 1 - ALIGNMENT OF SETTING PINS TO SETTING LEVERS

With the mult unit in home position, the left side of the first row of setting pins is to be flush with the left side of the setting levers. To adjust, loosen the screws on the escapement comb and move the mult unit right or left as required. Keep the comb level and allow approximately .015" clearance between it and the lip on the escapement lever.

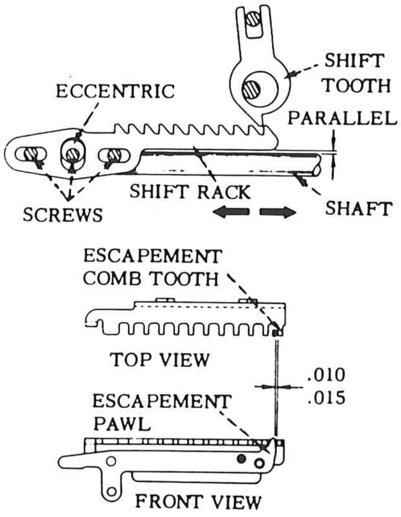


Fig. 2

FIG. 2 - SHIFT RACK

When the mult unit is shifting to the right, the tooth on the escapement comb is to overtravel the escapement pawl by .010" to .015". To adjust, move the shift rack right or left as required. Note: The eccentric is also used to prevent adjustment slippage. Keep it turned to the left.

ADJ. 4 - SELECTION

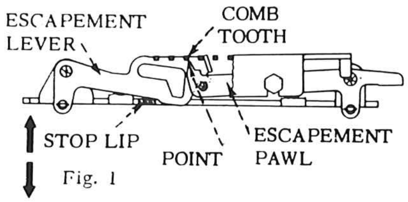


Fig. 1

FIG. 1 - STOP LIP

The stop lip is to stop the downward travel of the escapement lever just as the point of the escapement pawl releases from the comb tooth. Test in each position by depressing the zero key. To adjust, raise or lower the stop lip.

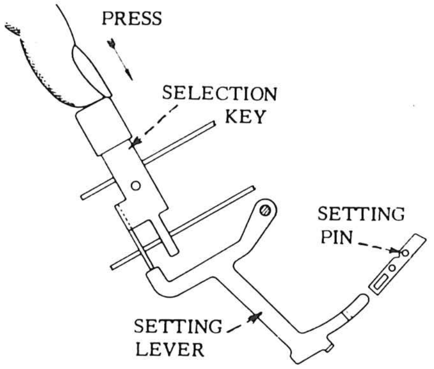


Fig. 2

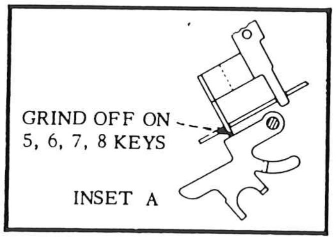


FIG. 2 - POSITIONING OF SETTING PINS

When a selection key is depressed, the setting lever is to fully raise the setting pin to its detent position, but not bottom against the setting pin excessively. To increase the movement of the setting lever, peen the keystem, or form the setting lever. To decrease the movement of the setting levers, insert a block between the setting lever and the setting pin and apply pressure on the selection key.

Note: The 5 through 8 setting levers (Inset A) are too short to form, therefore, it will be necessary to grind off the end of the key stem slightly if adjustment is required.

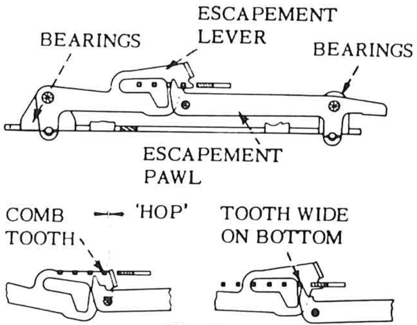


Fig. 3

FIG. 3 - ESCAPEMENT "HOP"

The escapement pawl and the escapement lever are positioned by their bearings so there will be a distinctive "hop" of the unit when the escapement pawl goes below the comb tooth. To adjust, form the bearings.

Continued on next page

ADJ. 4 - SELECTION

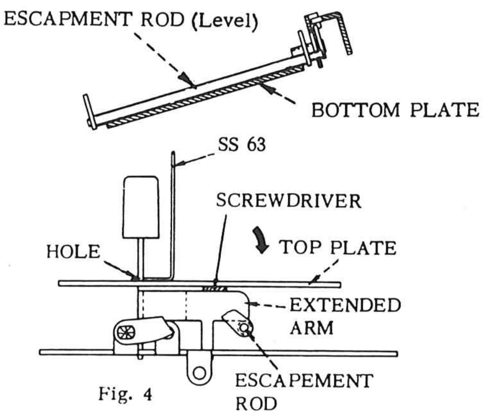


Fig. 4

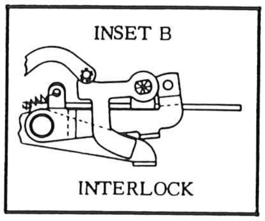


FIG. 4 - ESCAPEMENT ROD

Normally the escapement rod is to be level with the keyboard bottom plate; however, to obtain a faster escapement, it is sometimes necessary to lower the rear end of the rod slightly. Also to obtain a good escapement action on the 1, 4, and 7 keys, it is sometimes necessary to form the extended arm on the key stems. After adjusting check for binds in the interlock shown in Inset B.

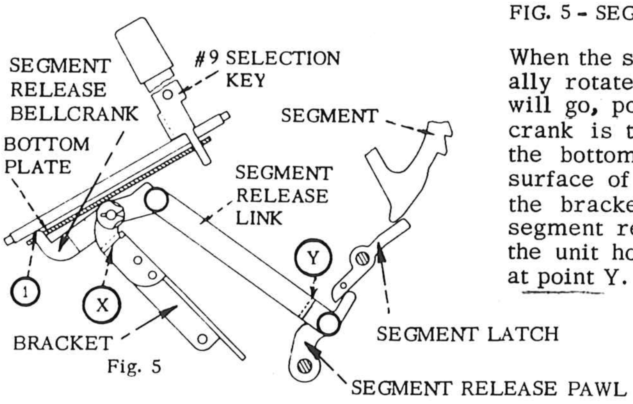


Fig. 5

FIG. 5 - SEGMENT RELEASE

When the segment release bellcrank is manually rotated counter clockwise as far as it will go, point 1 of the segment release bellcrank is to move below the top surface of the bottom plate, but not below the bottom surface of the bottom plate. To adjust, form the bracket at point X. Then to obtain the segment release after the pin set and before the unit hop, form the segment release link at point Y.

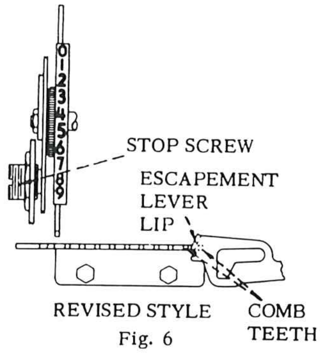


Fig. 6

FIG. 6 - STOP SCREW

When the mult unit is escaped to the extreme left, the escapement lever lip is to be free to move up and down without contacting the comb teeth or without sticking down. To adjust, turn the stop screw.

ADJ. 5 - LATCHING AND DELATCHING OF POWER SET SHIFT LEVER

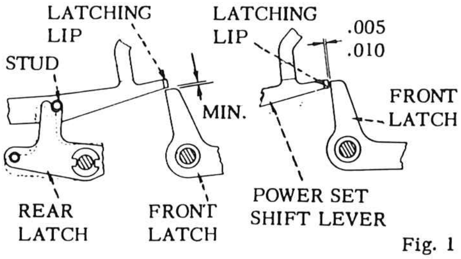


Fig. 1

FIG. 1 - FRONT LATCH

(1) With the stud on the power set shift lever latched on the rear latch, the lip on the power set shift lever is to have minimum clearance to the top of the front latch.

(2) With the machine cycled in mult until the front latch is pulled from under the latching lip, the lip is to clear the latch by .005" to .010". To adjust, form the latching lip. Check the machine in multiplication to see that the power set shift lever drops freely.

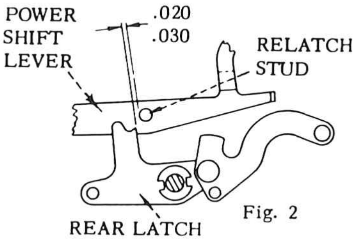


Fig. 2

FIG. 2 - REAR LATCH CLEARANCE TO RELATCH STUD

When the power set shift lever is delatched and drops, the relatch stud is to clear the latch by .020" to .030". If necessary to adjust, form the left end of the disengaging bail. Then recheck the carriage clear adjustment.

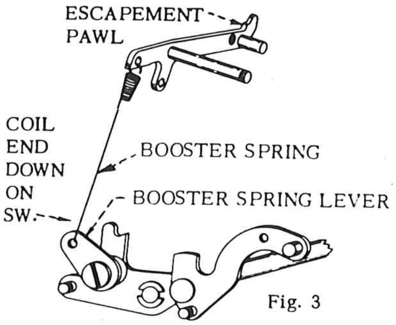


Fig. 3

FIG. 3 - BOOSTER SPRING

With the escapement pawl in home position, the booster spring is to have no tension on the pawl. To adjust, move the booster spring lever.

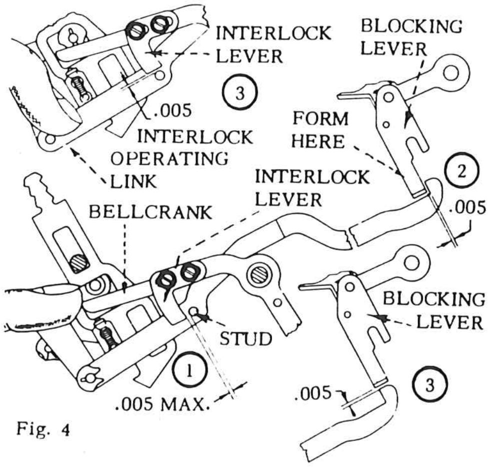


Fig. 4

FIG. 4 - INTERLOCK

(1) With the bellcrank depressed (machine in home position) the interlock lever is to have .005" clearance to the stud. To adjust, move the interlock lever.

(2) With the enter dividend key depressed, the blocking lever is to clear the interlock operating link by .005". To adjust, form the blocking lever.

(3) With the machine in home position and the interlock operating link pulled forward, check for .005" maximum clearance between the interlock and the stud. Also check for .005" clearance between the blocking lever and the link.

ADJ. 6 - ENGAGEMENT AND DISENGAGEMENT OF POWER SET CAM

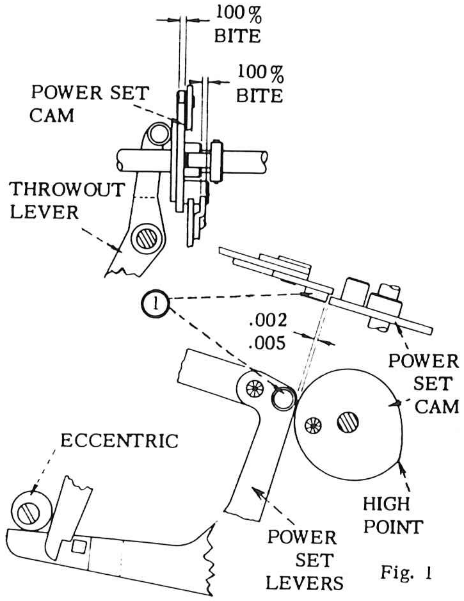


Fig. 1

FIG. 1 - ENGAGEMENT OF POWER SET CAM

With a figure selected in the mult unit, cycle the machine in mult until the power set cam moves in front of roller 1 (high point of cam toward front of the machine). The cam is to have 100% engagement with the roller as well as .002" to .005" clearance. Also when the power set cam is restored to home position, it is to clear the roller with a safe clearance. To adjust for engagement and disengagement, form the power set levers. To adjust for clearance, turn the eccentric.

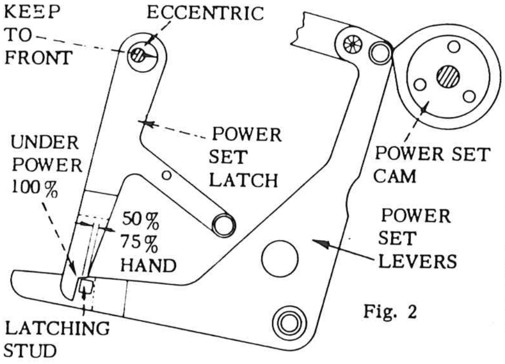


Fig. 2

FIG. 2 - POWER SET LATCH

With a figure selected in the mult unit, cycle the machine in negative mult until the power set cam is on the high point of movement with the power set levers. At this point the power set latch is to move onto the latching stud with a heavy drag and have a 50% to 75% bite. To adjust, rotate the eccentric but keep the high side to the front of the machine. Note: Under power operation the power set latch is to have a full 100% bite on the latching stud.

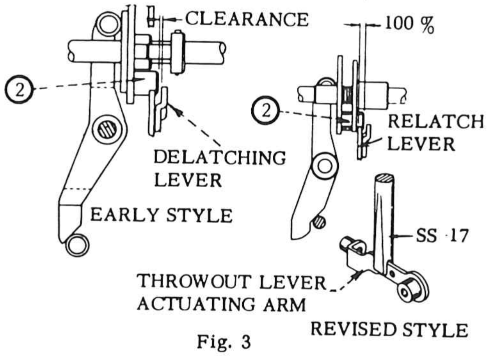


Fig. 3

FIG. 3 - POWER SET CAM AND RELATCH LEVER

With the machine cycled in mult until the last unit shift occurs there is to be 100% engagement of the relatch lever and the roller 2. Also there is to be clearance between the roller and the delatching lever. If necessary to adjust (Revised Style), form the throwout lever actuating arm. Early Style, recheck the adjustment shown in Fig. 1.

ADJ. 7 - GATE ENGAGEMENT AND MULT SHIFT

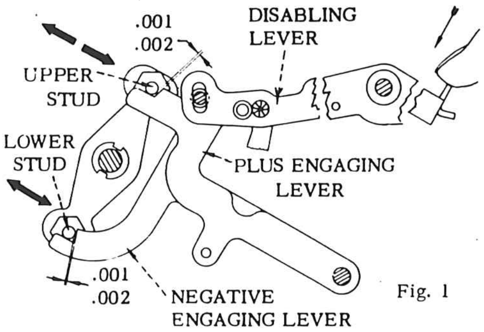


Fig. 1

FIG. 1 - PLUS AND NEGATIVE ENGAGING LEVERS

Both the plus and the negative engaging levers are to engage their respective gate operating studs with .001" to .002" clearance. To adjust, move the studs.

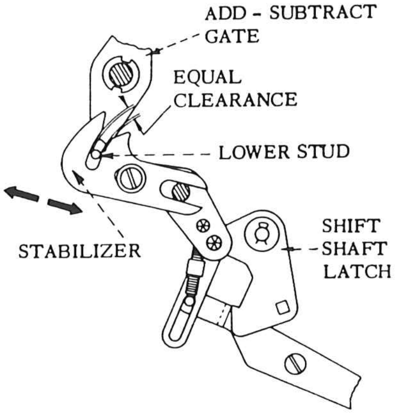


Fig. 2

FIG. 2 - GATE STABILIZER

With the gate in home position, manually delatch the shift shaft latch. The stabilizer is to straddle the lower stud with equal clearance on each side of the stud. To adjust, move the stabilizer.

Continued on next page

ADJ. 7 - GATE ENGAGEMENT AND MULT SHIFT

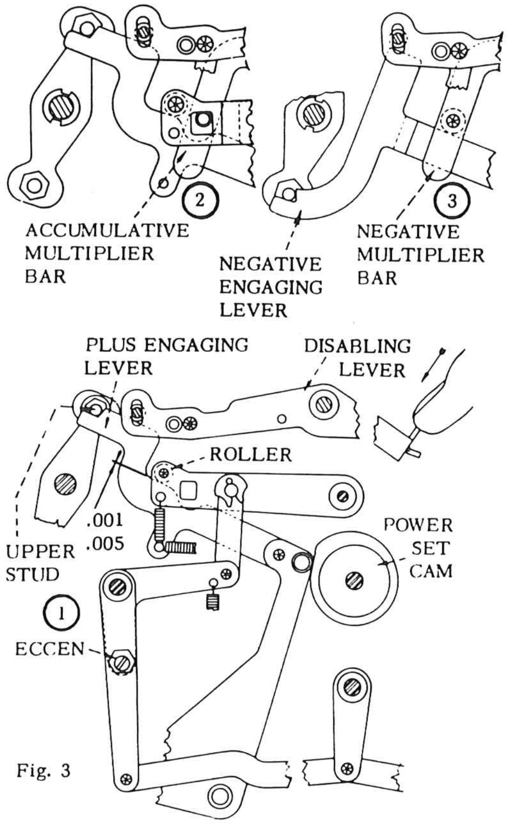


Fig. 3

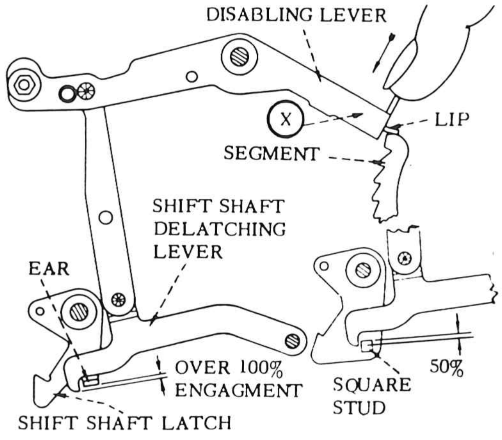
Fig. 3 - ENGAGEMENT OF POWER SET LEVERS

When the plus or the negative engaging lever is actuated into engagement with the upper or lower stud on the gate power set arm, there is to be .001" to .005" clearance between the roller and the engaging levers. To obtain this clearance on the different operating keys proceed as follows:

(1) Mult Key - turn the eccentric.

(2) Accum. Mult Key - spring the accumulative multiplier bar.

(3) Neg. Mult Key - spring the negative multiplier bar.



EARLY STYLE

Fig. 4

FIG. 4 - SHIFT SHAFT LATCH ENGAGEMENT

With two zeros selected in the mult unit, depress the disabling lever so the lip is resting on the segments. The hook on the shift shaft delatching lever is to engage the ear (revised shift shaft latch) with slightly more than a 100% bite. On the early style shift shaft latch (square stud), the engagement is to be 50%. To adjust, form the disabling lever up or down by twisting at point "X".

Continued on next page

MULTIPLICATION

ADJ. 7 - GATE ENGAGEMENT AND MULT SHIFT

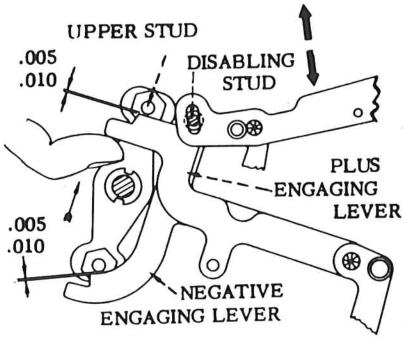


Fig. 5

FIG. 5 - ENGAGING LEVER CLEARANCE ON MULT SHIFT

When the plus and negative engaging levers are simultaneously actuated rearward, as a result of a mult unit shift and a carriage shift, they are to clear the upper and lower studs on the gate power set arm by .005" to .010". To adjust, move the disabling stud as required.

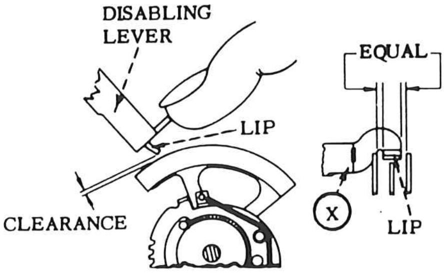


Fig. 6

FIG. 6 - DISABLING LEVER

There is to be equal clearance on each side of the disabling lever lip and the adjacent segment. To adjust, form the disabling lever at point "X".

The Lip on the disabling lever is to clear the segment dials. To adjust, form the Lip on the disabling lever. Check the clearance by selecting all 9's in the dials.

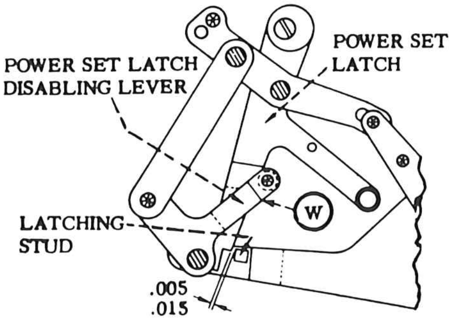


Fig. 7

FIG. 7 - POWER SET LATCH DISABLING

With the machine in home position the power set latch disabling lever is to hold the power set latch away from the latching stud by .005" to .015". To adjust, form the power set latch disabling lever at point "W".

Continued on next page

ADJ. 7 - GATE ENGAGEMENT AND MULT SHIFT

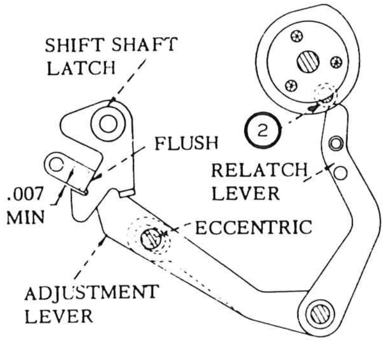


Fig. 8

FIG. 8 - OVERLATCH OF ADJUSTMENT LEVER

Manually cycle the drive shaft until roller 2 is on the high point of movement with the relatch lever. At this point the adjustment lever is to overlatch the shift shaft latch with a minimum of .007" clearance. To adjust, turn the eccentric. Also check to see that the shift shaft latch rests flush against the end of the adjustment lever. If necessary to adjust, form the end of the adjustment lever and recheck the overlatch.

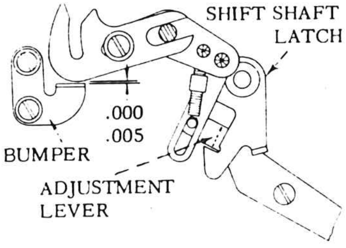


Fig. 9

FIG 9 - STABILIZER BUMPER

Manually cycle the drive shaft in mult until the adjustment lever has reached its maximum overlatch. There is to be .000" to .005" clearance between the stabilizer and the bumper. To adjust, form the bumper.

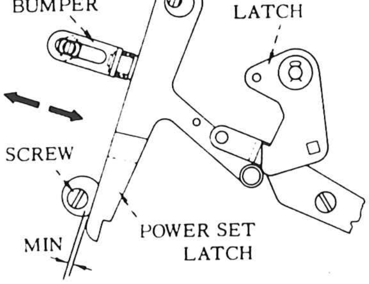


Fig. 10

FIG. 10 - POWER SET LATCH BUMPER

When the power set latch is manually moved all the way to the rear it is to have minimum clearance but not contact the screw. To adjust, move the bumper bracket as required.

ADJ. 8 - TERMINATION

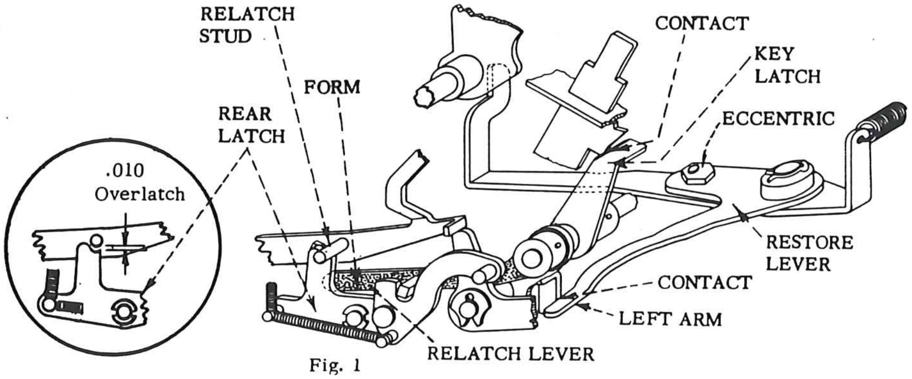


FIG. 1 - RELATCHING OF POWER SET SHIFT LEVER

(1) With the mult unit in home position, the key latches are to rest against their respective mult keys, the left arm on the restore lever is to contact the lower end of the key latch with no pressure, and the relatch lever is to rest on the hub of the rear latch. To adjust, turn the eccentric.

(2) Manually cycle the machine in mult until the last unit shift to the right raises the relatch lever. The relatch lever is to raise the relatch stud approximately .010" above the latch lip on the rear latch. To adjust, form the end of the relatch lever at point indicated.

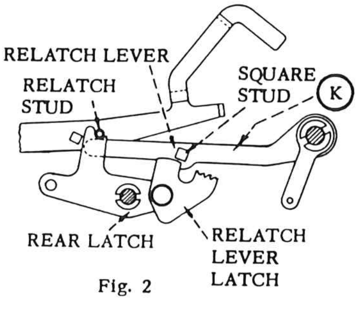


FIG. 2 - RELATCH LEVER LATCH

When a mult key is held depressed during a mult operation, the relatch lever latch will move under the square stud at the time of mult termination and prevent the key being relatched without a left shift. To check this, release and redepress the mult key in rapid succession (power on), the key is not to latch without going into a left shift. To adjust, twist the relatch lever at point "K" to raise or lower the square stud.

ADJ. 9 - SEGMENT FEED

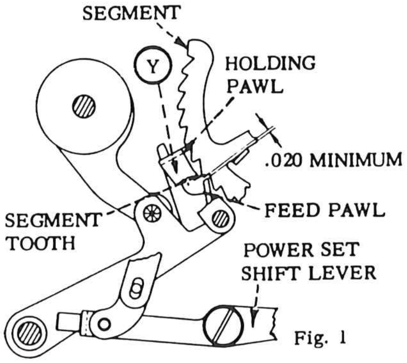


Fig. 1

Fig. 1 - FEED AND HOLDING PAWL OVERLATCH

With a "9" selected in the first segment, cycle the machine in mult until the power set shift lever is fully rotated. Then continue to rotate the drive shaft until the feed pawl is at its lowest point of movement. At this point, the feed pawl is to have a minimum of .020" clearance to the tooth of the segment. To adjust, form the holding pawl at point "Y". Note: Recheck this adjustment in repeat mult.

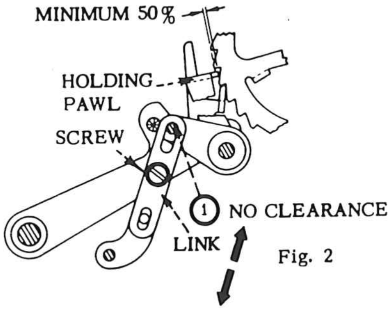


Fig. 2

Fig. 2 - ENGAGEMENT

With a figure selected in the first segment, cycle the machine in mult until the holding pawl engages the segment tooth. The holding pawl is to have no less than 50% engagement with the segment tooth, and the link is to have no clearance to the stud as shown at point 1. To adjust, move the link.

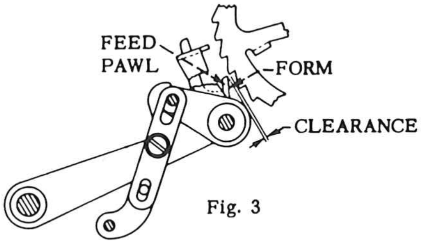


Fig. 3

Fig. 3 - FEED AND HOLDING PAWL DISENGAGEMENT

With the plus key depressed cycle the drive shaft to move the feed pawl up and down. The feed pawl must have clearance to the segment teeth. To adjust, form the feed pawl at point indicated.

ADJ. 10 - CARRIAGE SHIFT ENGAGEMENT AND DISENGAGEMENT

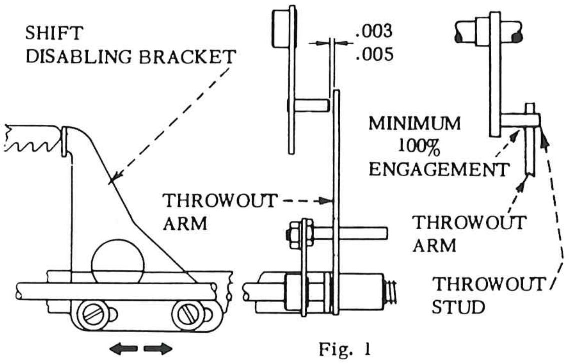


Fig. 1

FIG. 1 - ALL MODELS EXCEPT SQUARING

With the mult unit escaped one position the shift throwout arm is to clear the end of the throwout stud by .003" to .005". With the unit escaped two or more positions, the throwout arm is to have 100% (minimum) engagement with the throwout stud. To adjust, move the shift disabling bracket. Recheck the adjustment using the repeat mult key.

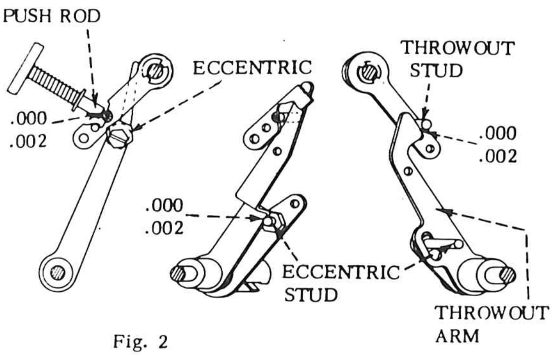


Fig. 2

FIG. 2 - ALL MODELS EXCEPT SQUARING

With the shift throwout arm engaged on the throwout stud there is to be .000" to .002" clearance between the arm and the stud. To adjust, turn the eccentric or the eccentric stud depending on the model machine and the type of throwout arm. On Grayline machines it is necessary to peen the rear edge of the throwout arm.

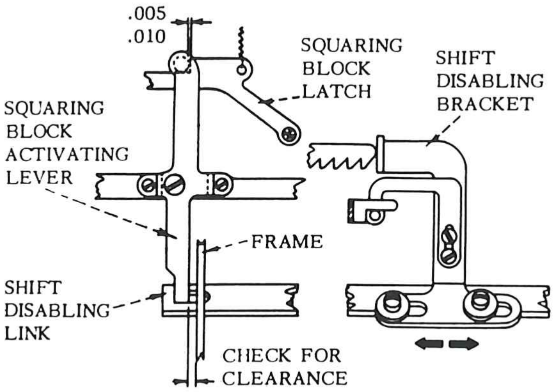


Fig. 3

FIG. 3 - SQUARING MODELS
(Shift Disabling Bracket)

The following sequence adjustment steps apply to the "Q" line (automatic squaring) and must be made at this time in order to have the mult unit function properly before the squaring feature is adjusted.

(1) Cycle the machine in mult correction until the last unit shift to the right. Then with the shift disabling link at its maximum travel to the right the upper end of the squaring block activating lever is to overlatch on the squaring block latch by .005" to .010". To adjust, move the shift disabling lever bracket as required. Check to see that the lower end of the squaring block activating lever does not contact the left side frame. If it does, form the lower end of the lever to obtain clearance.

NOTE: On machines with squaring, the shift disabling bracket is used strictly to adjust the over-latch of the squaring block activating lever.

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ADJ. 10 - CARRIAGE SHIFT ENGAGEMENT AND DISENGAGEMENT

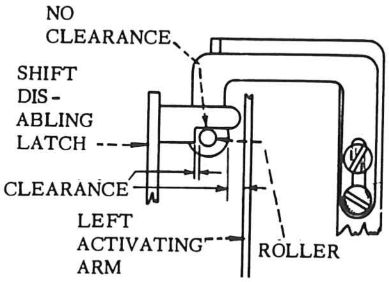


Fig. 4

FIG. 4 - SQUARING MODELS

(Shift Delay Arm Bracket)

(2) With the machine in home position and no selection in the mult unit the shift disabling latch should rest against the roller on the shift delay arm bracket with no clearance.

(3) With the mult unit at its maximum overtravel to the right (past home), check to see that the end of the bracket does not contact the left activating arm. To adjust, move the shift delay arm bracket as required but do not "cock" the bracket excessively since clearance must be maintained between the left edge of the roller and the shift disabling latch.

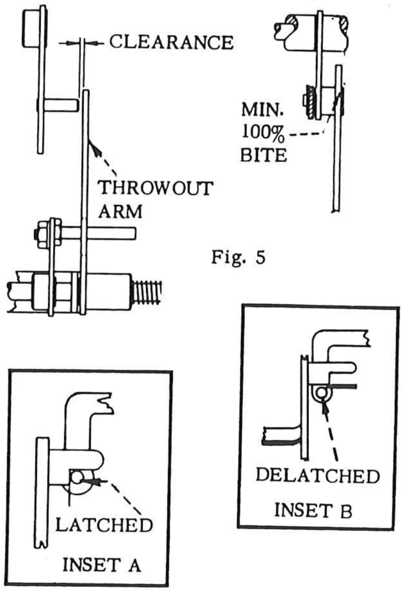


Fig. 5

FIG. 5 - SQUARING MODELS (Shift Throwout Arm)

(4) With the shift disabling latch engaged on the shift delay arm bracket roller as shown in Inset A, there is to be clearance between the throwout arm and the throwout stud. When the shift disabling latch is delatched as shown in Inset B, the throwout arm is to have 100% engagement with the throwout stud. To adjust, form the throwout arm as required.

ADJ. 11 - REPEAT MULT

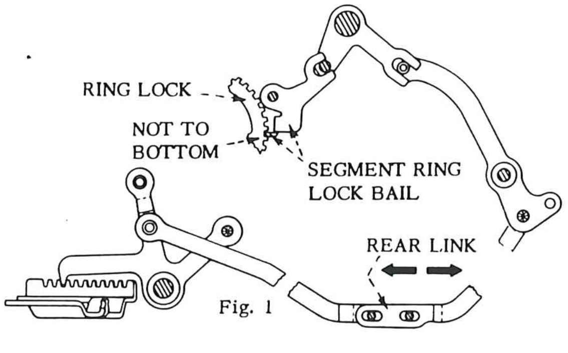


Fig. 1

FIG. 1 - SEGMENT RING LOCK BAIL

When the repeat key is in the forward position, the segment ring lock bail is to engage the ring lock without bottoming. To adjust, move the rear link.

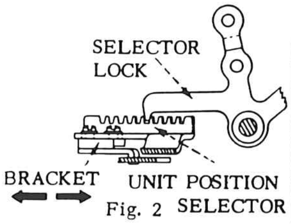


Fig. 2

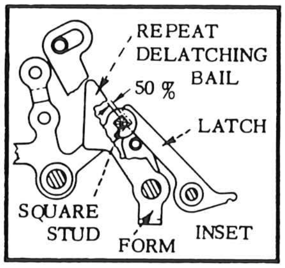


FIG. 2 - UNIT POSITION SELECTOR

Select a figure in the unit and pull the repeat key forward. As the selector lock enters a tooth space, the unit position selector is to have maximum rearward motion without causing a hard repeat key action. To adjust, move the bracket.

INSET (Repeat Delatching Early Style)

When the repeat key is forward, the latch is to have a 50% engagement on the square stud. To adjust, twist the repeat delatching bail. Note: The latch is to delatch just before the clutch is released on a slow depression of the mult correction key.

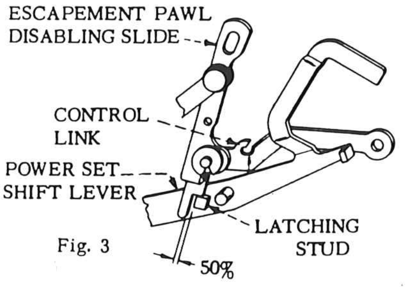


Fig. 3

FIG. 3 - ESCAPEMENT PAWL DISABLING SLIDE

With the machine in repeat mult operation, the escapement pawl disabling slide is to have a 50% engagement on the latching stud. To adjust, form the control link. Check in regular mult to see that the escapement pawl disabling slide doesn't catch the latching stud.

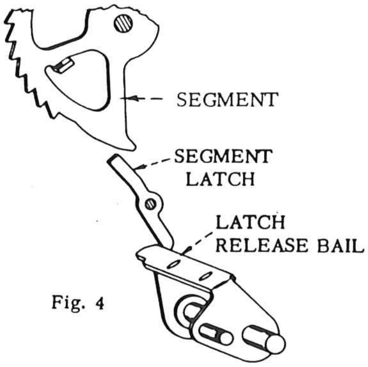
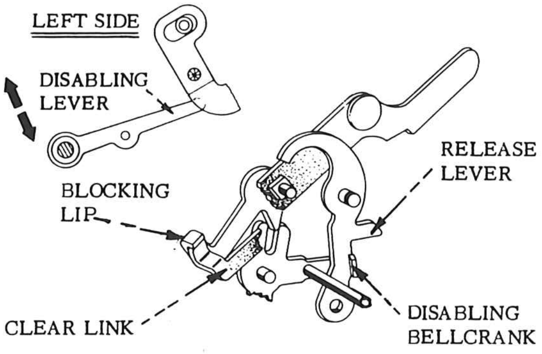


Fig. 4

FIG. 4 - LATCH RELEASE BAIL

As the unit is released to position in repeat mult, the latch release bail is to delatch the segment latches and release the segments to the same selection previously multiplied. To adjust, form the latch release bail.

ADJ. 12 - KEYBOARD CLEAR DISABLING (Mult Correction)



When the add-key is down and the mult correction key is latched, the disabling bellcrank is to move down far enough to allow the release lever to swing into latching position. To adjust, form the disabling lever. Also check to see that the blocking lip is formed rearward enough to prevent the clear link slipping off and catching as it moves to the rear.

ADJ. 13 - MODEL SW

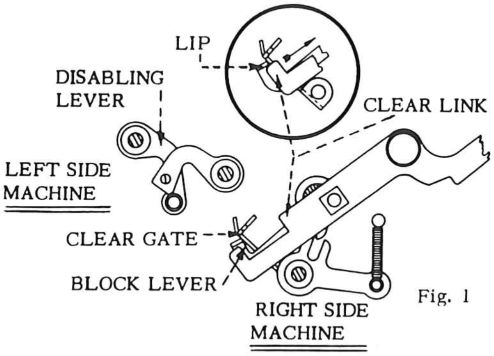


Fig. 1

Fig. 1 - KEYBOARD CLEAR DISABLING

When the mult setting key is in the mult correction position, the block lever is to hold the clear link below the clear gate. If necessary to adjust, align the disabling lever. Also check to see that the lip on the block lever is formed to the rear enough to prevent the clear link slipping off at its extreme rearward travel.

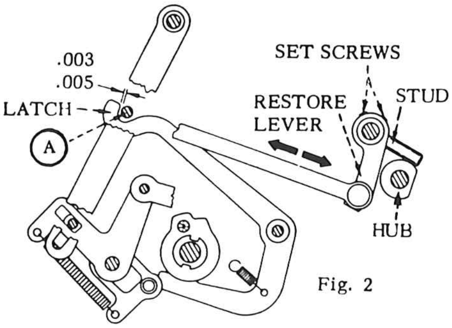


Fig. 2

FIG. 2 - RESET CONTROL LEVERS

When the unit is shifting to the extreme right and the reset stud is on the hub, there is to be .003" to .005" clearance between stud "A" and the latch. To adjust, move the restore lever.

Continued on next page

MULTIPLICATION

ADJ. 13 - MODEL SW

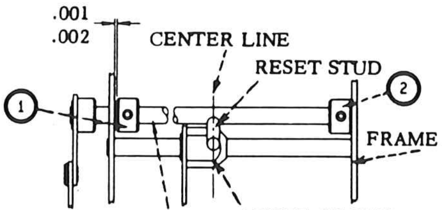


Fig. 3

FIG. 3 - RESET CONTROL SHAFT

When the unit is shifting to the extreme right, the edge of the hub is to pass the center line of the reset stud before the unit drops back. To adjust, loosen the collars 1 and 2 and move the reset control shaft right or left. When set, position and tighten collar 2 against the frame; then position and tighten collar 1 for .001" to .002" end play.

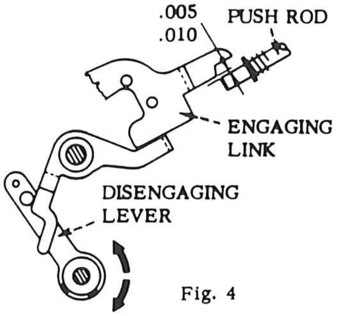


Fig. 4

FIG. 4 - CLEAR DISABLING LEVER - MULT CORRECTION

When the multiplier setting lever is pulled to the mult correction position, the engaging link is to clear the push rod by .005" to .010". To adjust, rotate the disengaging lever.

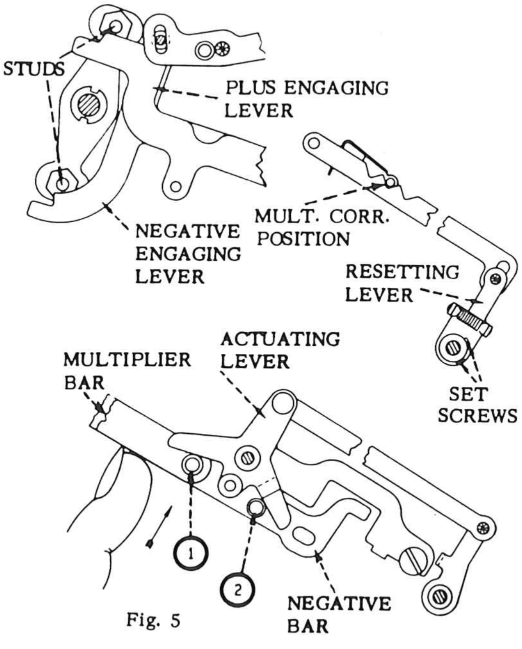


Fig. 5

Fig. 5 - SET-UP FOR PLUS, MINUS AND CORRECTION

In mult correction the plus and negative engaging levers are not to engage the studs on the gate power set arm. To adjust, first loosen the set-screws on the resetting lever and position the multiplier setting key in the mult correction position. Then hold both the multiplier bar and the negative bar upward with their tops even and with rollers 1 and 2 centralized and against the actuating lever. Tighten the set-screws.

ADJ. 14 - GRAY LINE MACHINES

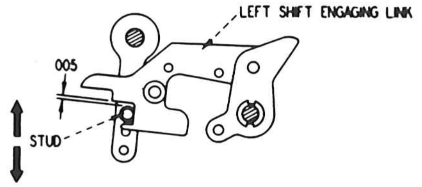


FIG. 1 - LEFT SHIFT DISABLING - MULT. CORRECTION

Depress the mult correction key and form the stud for .005" clearance to the left shift engaging link.

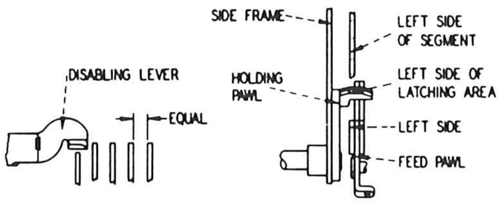


FIG. 2 - FEED PAWL DISABLING LEVER

(1) Align the holding pawl parallel with the side frame.
(2) Align the feed pawl so its left side is in line with the left side of the holding pawl latching area.
(3) Align all segments for equal spacing at top. Enter one figure into the mult unit, manually depress the disabling lever and escape the unit by depressing the zero key. The segment will position against the disabling lever. Adjust the disabling lever to the right or the left to position the left side of the segment to the left side of the feed pawl.

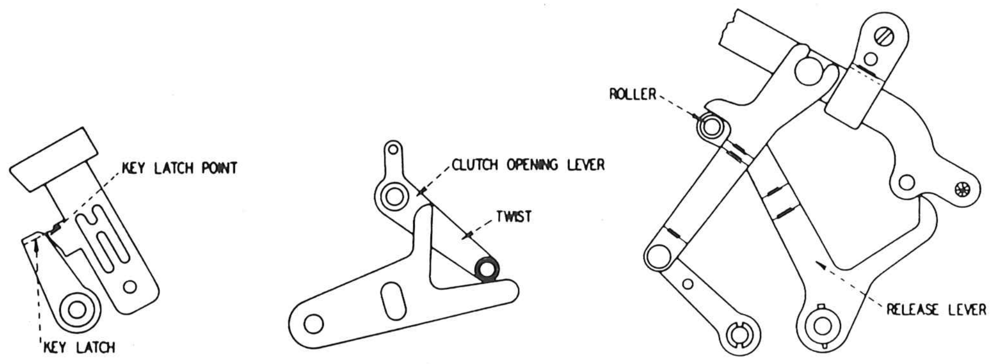


FIG. 3 - CLUTCH RELEASING - GRAY LINE MULT KEYS

The clutch is to release slightly before the key latch slips over the key latch point of the multiplier, the accumulative mult., and the negative mult keys. To adjust for the mult key, twist the clutch opening lever. For the accum. and neg. keys, form the release lever to change the position of the roller.

Continued On Next Page

ADJ. 14 - GRAY LINE MACHINES

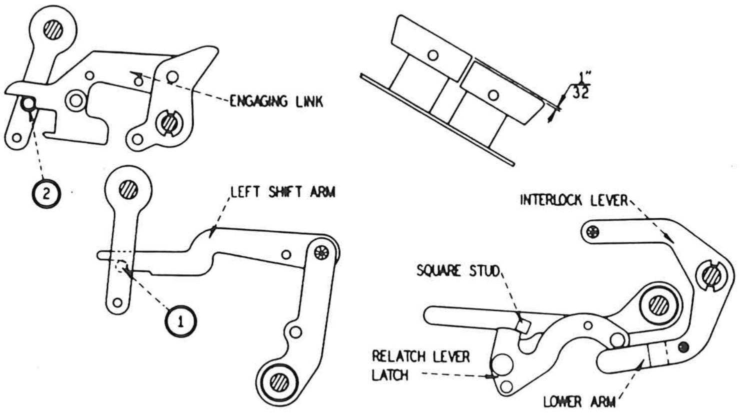


FIG. 4 - LEFT SHIFT ENGAGING LINK RESTORE

With the mult unit in home position, depress and hold down the accumulative mult key; then slowly release it. The square stud is to remain on top of the relatch lever latch until the key is 1/32" or less from reaching its top travel. Before the square stud drops, the left shift arm is to be restored on stud 1. To adjust, form the lower arm of the interlock lever. It may also be necessary to twist the arm of stud 1.

To adjust: (1) Form the lower arm of the interlock lever, or if necessary, form the arm of stud 1 to position the stud to the rear. The square stud must be off the relatch lever latch before the key is restored. (2) Repeat the above operation with the mult key. The square stud is to remain on top of the relatch lever latch until the engaging link has restored on stud 2. Check the adjustment at the lower arm, however, before adjusting check the clearance of the clip to the shift fork.

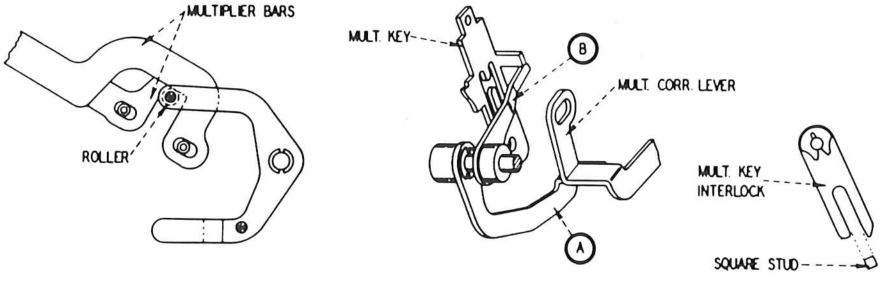


FIG. 5 - INTERLOCK LEVER

When the roller is held against the multiplier bars; Arm A is against the mult corr. lever; and Arm B is against the mult key; the mult key interlock when depressed is to straddle the square stud. To adjust, form arms A or B to align the interlock.

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ADJ. 14 - GRAY LINE MACHINES

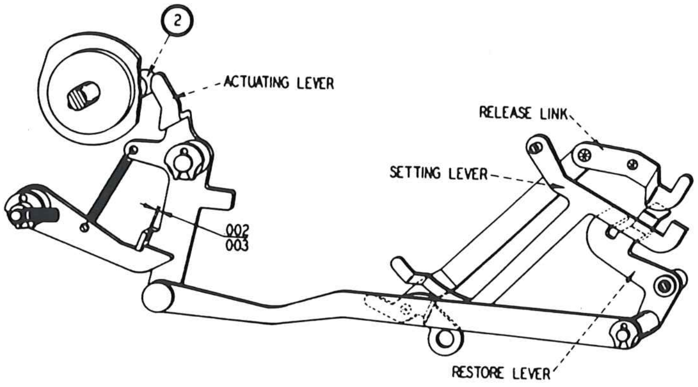

FIG. 6 - MULTIPLIER SETTING RESTORE LEVER

Operate the machine in multiplication. When roller 2 and the actuating lever are at the point of maximum movement, there is to be .002" to .003" overlatch as illustrated. To adjust, form the actuating lever. When the actuating lever is latched, the restore lever is to be snug but not binding against the setting levers and the release link. To adjust, form the restore lever arm.

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3

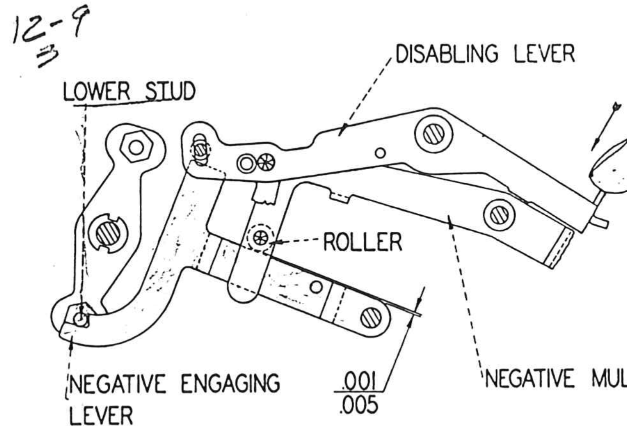


FIG. 1

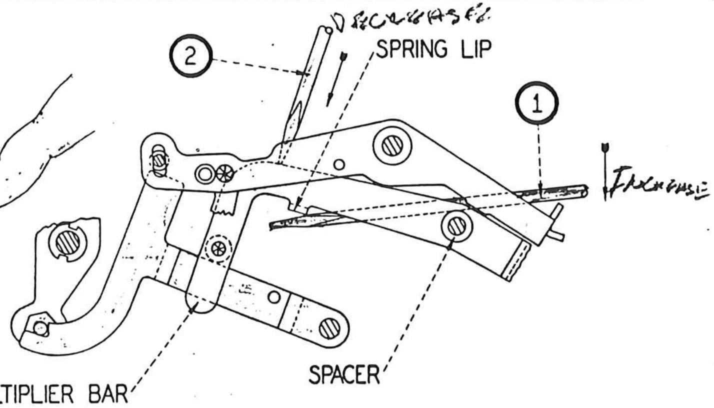


FIG. 2

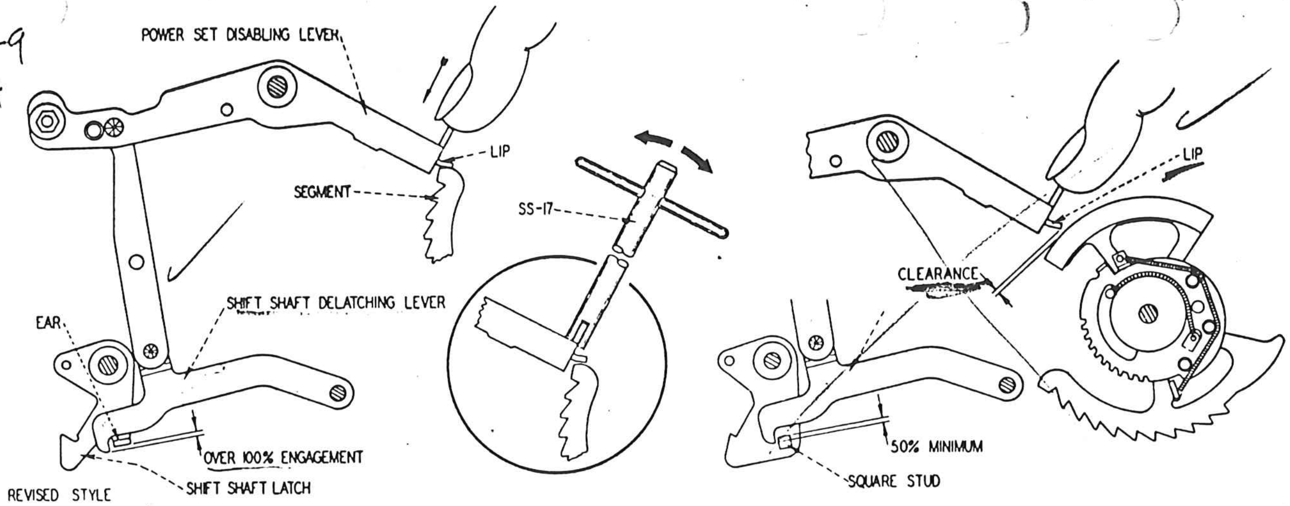
ST - S - STW - ACG - SW - SRW

ADJ. 61C NEGATIVE MULTIPLIER BAR: Fig. 1, Select a figure in the Unit, depress the Negative Key and press on the Disabling Lever. The Negative Engaging Lever is to stop against the Lower Stud and there is to be .001 - .005 clearance between the Roller and the Negative Engaging Lever. To obtain this clearance, Fig. 2, release the Negative Key and depress the Accumulator Key. Insert Screwdriver 1 under the Spring Lip and over the Spacer and move in the direction of the arrow. To decrease the clearance, press on the Negative Multiplier Bar with Screwdriver 2.

Reason for Adjustment: [illegible] insure a positive engagement between the Negative Engaging Lever and the ~~Upper~~ Lower Stud so the Negative Engaging Lever does not slip under when actuated by the Power Set Cam.

Oil the bearings.

12-9
4



ST - S - STW - ACG - SW - SRW

ADJ. 62A, REV. 1 - POWER SET DISABLING LEVER LIP: Place zeros in the Unit and press the Lip of the Disabling Lever against the Segment. The Shift Shaft Delatching Lever is to have over 100% engagement with the Ear of the Shift Shaft Latch. Form the Lip per inset. After forming, select 9's and depress the Neg Mult Key. Press down on the Disabling Lever. The Lip should clear the numbered part of all Segments.

Reason for Adjustment: To insure sufficient engagement of the Delatching Lever with the Ear when the Sector is fed to zero. Insufficient engagement will cause the Delatching Lever to be pulled over the top of the Ear and cause it to jam on the front side.

ADJ. 1 - LATCHING & DELATCHING OF SQUARING SHAFT

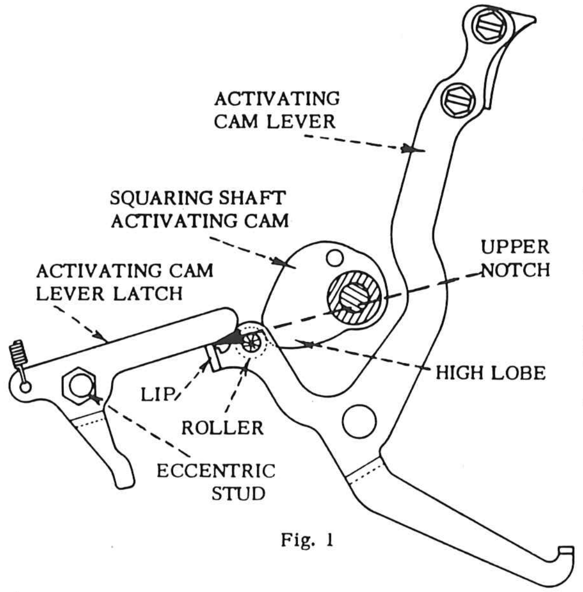


Fig. 1

FIG. 1 - ACTIVATING CAM LEVER LATCH

When the roller on the activating cam lever is at its maximum movement with the high lobe of the squaring shaft activating cam, the upper notch on the latch is to engage the lip on the squaring shaft activating cam lever with a slight drag, no clearance, and have a 100% bite. To adjust, turn the eccentric stud as required. Check under power to see that the activating cam lever has minimum movement as the cam contacts the roller.

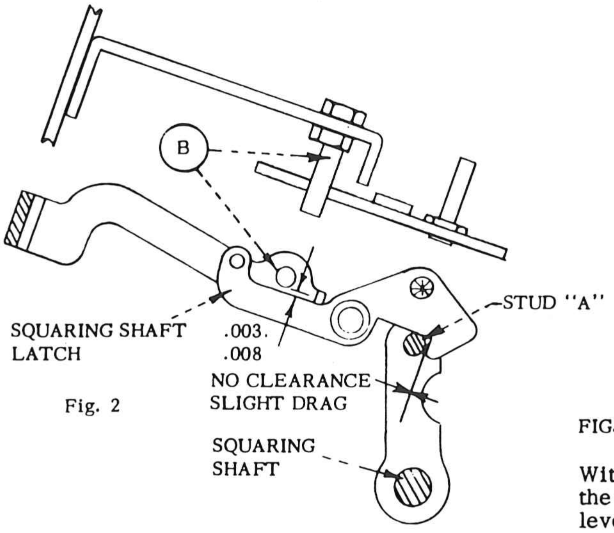


Fig. 2

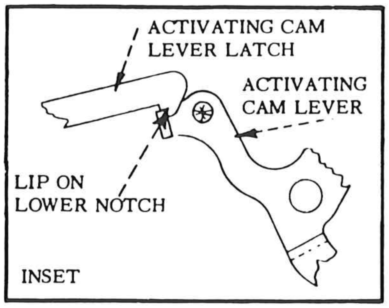


FIG. 2 - SQUARING SHAFT LATCH

With the machine in home position and the lower notch on the activating cam lever latch engaged on the activating cam lever lip as shown in the Inset, the squaring shaft latch is to engage stud "A" with a slight drag, no clearance, and have a 100% bite. Also, there is to be .003" to .008" clearance between the squaring shaft latch and eccentric stud "B". To adjust, turn the eccentric studs "A" and "B".

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ADJ. 1 - LATCHING & DELATCHING OF SQUARING SHAFT

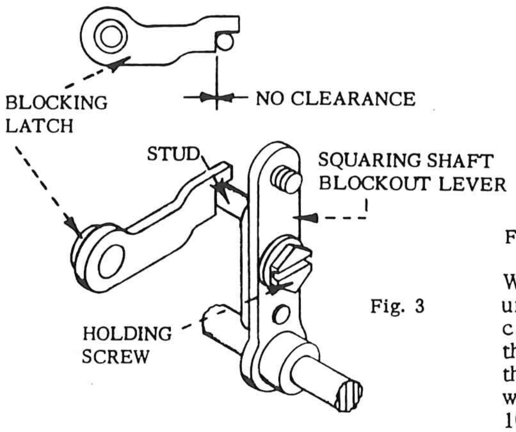
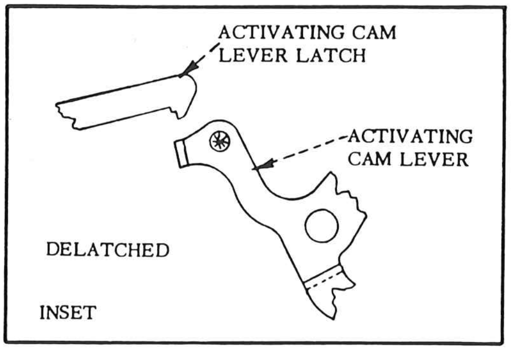


Fig. 3

FIG. 3 - SQUARING SHAFT BLOCKING LATCH

With the machine in home position, the mult unit escaped one position, and the activating cam lever delatched as shown in the Inset, the squaring shaft blocking latch is to engage the stud on the squaring shaft blockout lever with a slight drag, no clearance, and have a 100% bite. To adjust, move the stud as required.



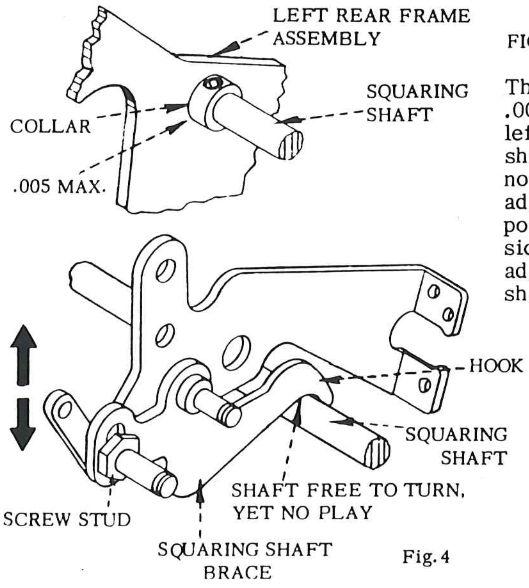


Fig.4

FIG. 4 - SQUARING SHAFT END PLAY

The squaring shaft is to have a maximum of .005" end play between the collar and the left rear frame assembly. Also, when the shaft is rotated by its power spring, it is not to bow or spring out of alignment. To adjust, move the shaft as far to the right as possible and tighten the collar against the side frame. Then raise the slotted end of the adjustable brace until the hook contacts the shaft. Check to see that the shaft is free.

ADJ. 2 - SENSING CAM SHAFT

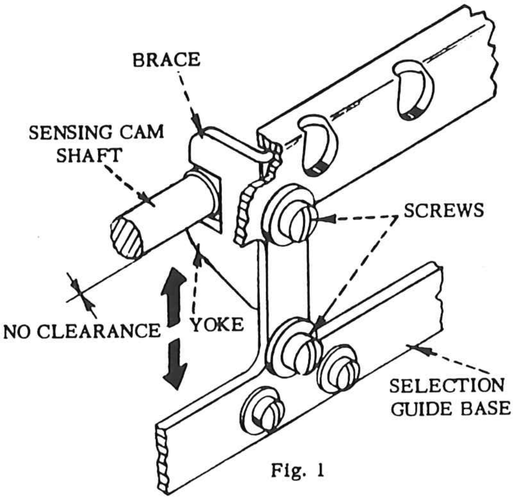
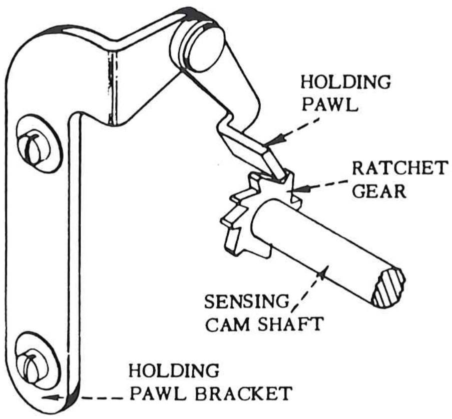


Fig. 1

FIG. 1 - SENSING CAM SHAFT BRACE

The sensing cam shaft is to be prevented from excessive bowing up or down as a result of the movement of the cam shaft feed pawl, or of the draw bar movement. To adjust, move the brace so the rear yoke is against the shaft. Slight readjustment may be necessary to improve the selection on the center step cams. If so, recheck the cam shaft feed pawl adjustment.



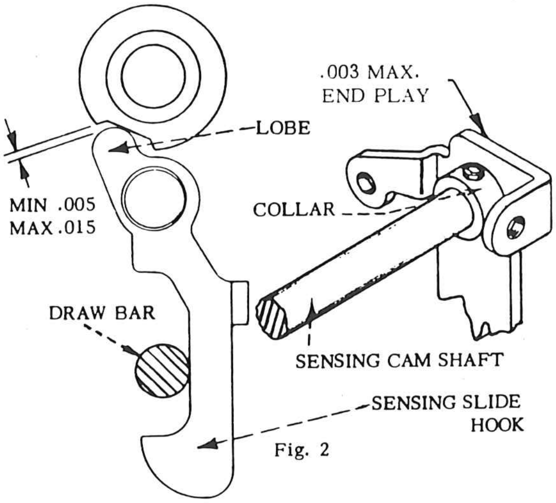


Fig. 2

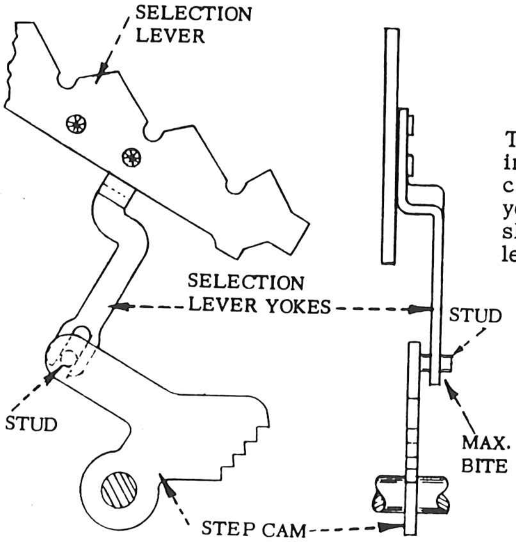
FIG. 2 - CAM SHAFT HOME POSITION

(1) With the sensing cam shaft in home position (lobe of #1 hook in low dwell of cam) and the tooth on the ratchet gear tight against the holding pawl, there is to be a minimum of .005" and a maximum of .015" clearance between the lobe on the sensing slide hook and the trailing edge of the cam. To adjust, move the holding pawl bracket.

(2) The sensing cam shaft is to have a maximum of .003" end play to prevent binding. To adjust, move the collar against the bracket and check the end play by moving the shaft alternately from right to left.

SQUARING

ADJ. 3 - ENGAGEMENT OF SELECTION LEVER YOKES



The selection lever yokes are to have maximum engagement to the studs on the step cams without binding. To adjust, form the yokes. Check to see that the yokes can not slip off the studs and that the selection levers and step cams are free.

ADJ. 4 - AUTO SQUARE CONTROL LEVER

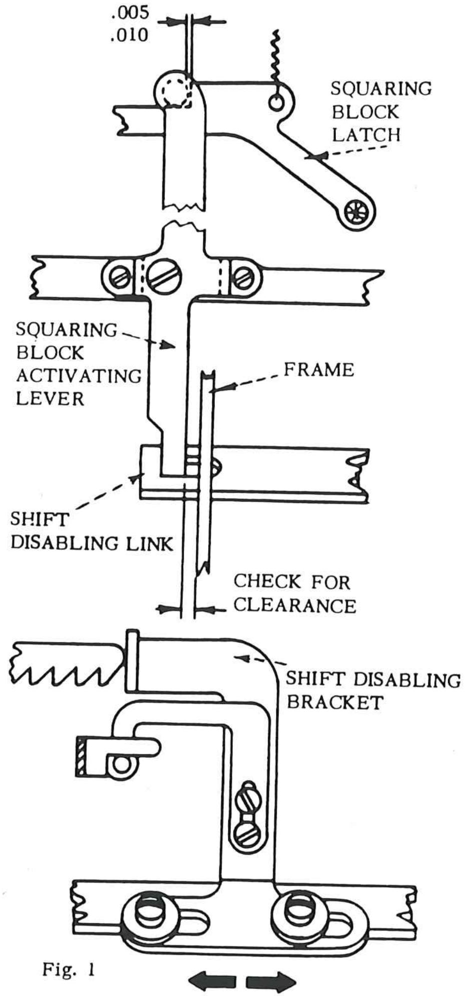


FIG. 1 - SQUARING BLOCK LATCH

With the shift disabling link at its maximum travel to the right, the upper end of the squaring block activating lever is to overlatch on the squaring block latch by .005" to .010". To adjust, move the shift disabling lever bracket as required. Check to see that the lower end of the squaring block activating lever does not contact the left side frame. If it does, form the lower end of the lever to obtain clearance.

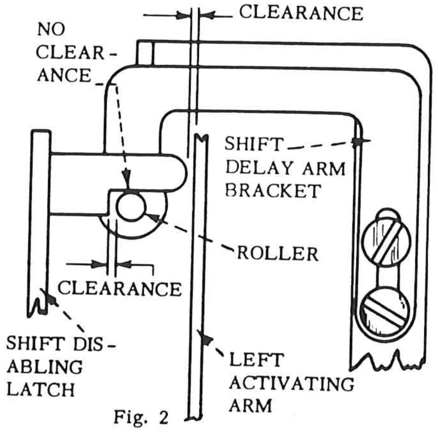


FIG. 2 - SHIFT DISABLING LATCH

(1) With the machine in home position and no selection in the mult unit, the shift disabling latch is to rest against the roller on the shift delay arm bracket with no clearance.

(2) With the mult unit at its maximum overtravel to the right, check to see that the end of the bracket does not contact the left activating arm. To adjust, move the shift delay arm bracket as required. Do not "cock" the bracket excessively since clearance must be maintained between the left edge of the roller and the shift disabling latch.

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ADJ. 4 - AUTO SQUARE CONTROL LEVER

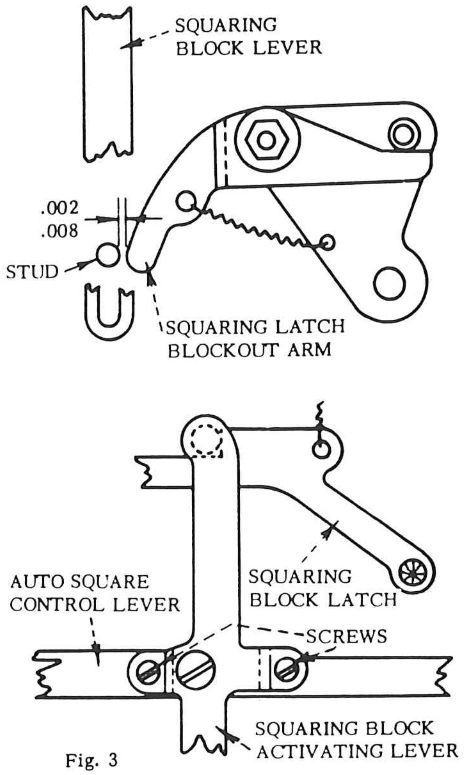

Fig. 3

FIG. 3 - SQUARING LATCH BLOCKOUT ARM

With the mult unit in home position (squaring block activating lever latched) and the mult key depressed, the nose on the squaring latch blockout arm is to clear the stud on the squaring block lever by .002" to 008". To adjust, move the auto square control lever while holding the squaring block activating lever stationary.

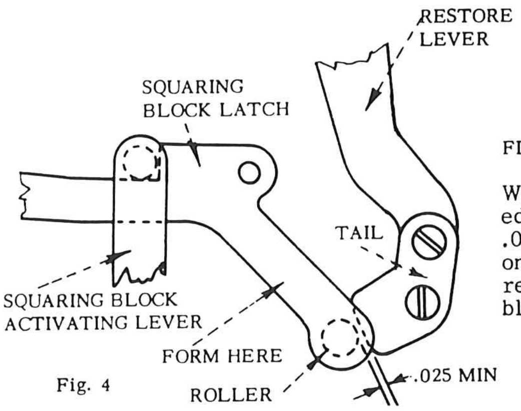

Fig. 4

FIG. 4 - SQUARING BLOCK LATCH LEVER

With the squaring block activating lever latched (mult unit in home position) there is to be .025" minimum clearance between the roller on the squaring block latch and the tail on the restore lever. To adjust, form the squaring block latch as required.

ADJ. 5 - UNIT RELEASE LEVER BRACKET

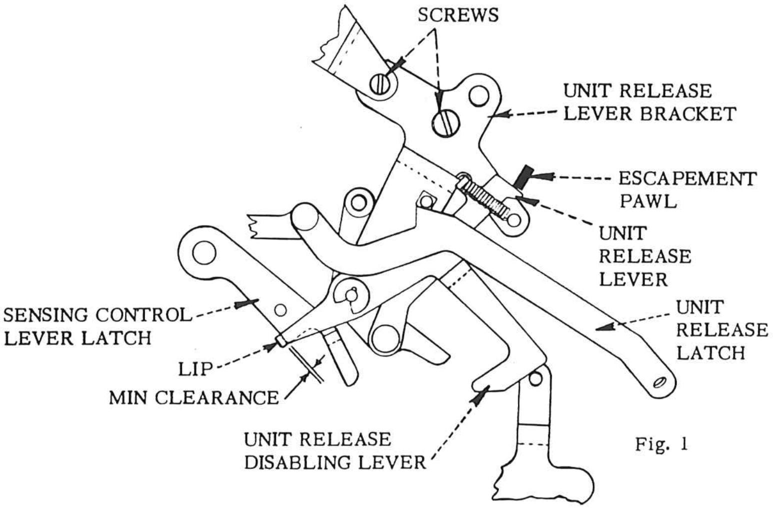
SCREWS
UNIT RELEASE LEVER BRACKET
ESCAPEMENT PAWL
UNIT RELEASE LEVER
UNIT RELEASE LATCH
SENSING CONTROL LEVER LATCH
LIP
MIN CLEARANCE
UNIT RELEASE DISABLING LEVER
Fig. 1

FIG. 1 - POSITION OF UNIT RELEASE LEVER BRACKET

The unit is to escape to the fixed stop position without the escapement pawl dragging on the escapement comb and with minimum clearance of the pawl to the underside of the comb. To adjust, rotate the unit release lever bracket as required, but keep the bracket raised as high as possible. This is the primary adjustment for the bracket, however, the requirements outlined in the following steps must also be observed.

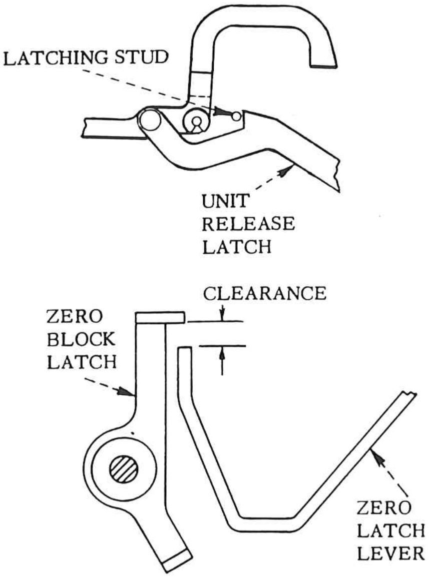

Fig. 2

FIG. 2 - ZERO LATCH LEVER

(1) The unit release latch is to delatch and relatch without binding on the latching stud.

(2) With the machine in home position, check to see that the lip on the zero latch lever has clearance below the underside of the zero block latch. Normally this clearance will be found adequate but in some cases it may be necessary to readjust the unit release lever bracket or form the zero latch lever. (See Adj. 13, Fig. 2 for the adjustment of the zero block latch.)

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ADJ. 5 - UNIT RELEASE LEVER BRACKET

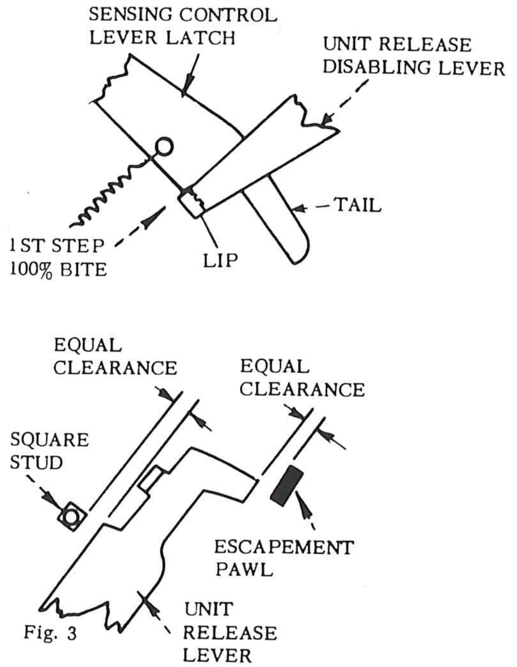


Fig. 3

FIG. 3 - SENSING CONTROL LEVER LATCH

(1) With the machine in home position, the lip on the unit release disabling lever is to have minimum clearance to the sensing control lever latch but is not to drag. To adjust, form the tail on the sensing control lever latch. (See Fig. 1.)

(2) With the machine in a squaring operation, the lip on the unit release disabling lever is to latch on the 1st step of the sensing control lever latch with a 100% engagement. Also, the unit release lever is to be approximately centered between the escapement pawl tail and the square stud. Readjust the unit release lever bracket.

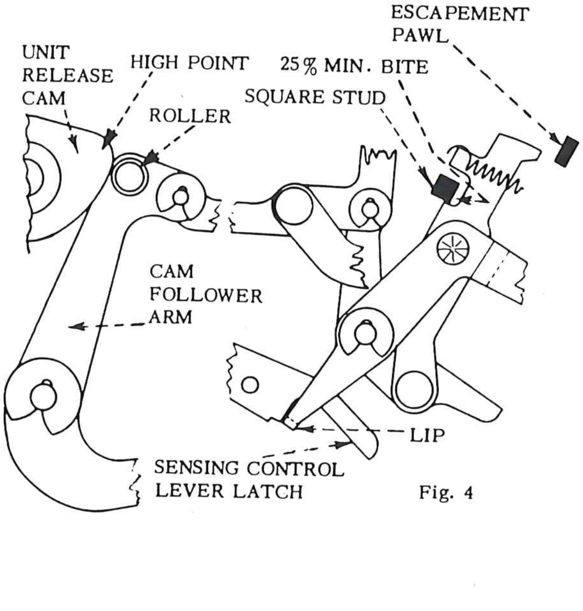
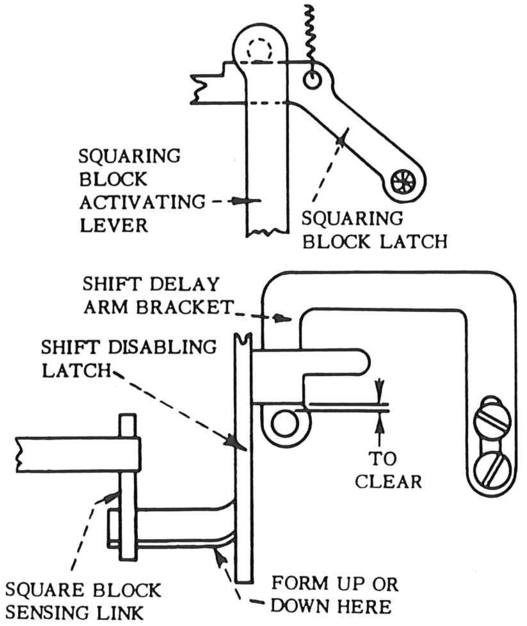


Fig. 4

FIG. 4 - DISABLING OF UNIT RELEASE LEVER

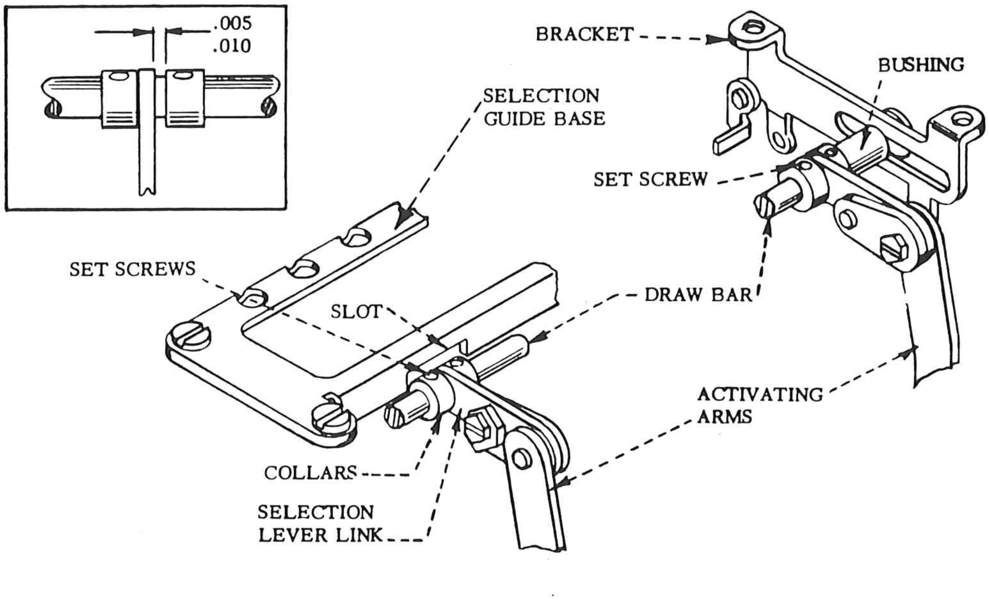
With a figure selected in the mult unit, cycle the machine in mult correction one-revolution to position the roller on the unit release cam follower arm just past the high point of the unit release cam. At this point the lip on the unit release disabling lever is to latch on the 2nd step of the sensing control lever latch, and the edge of the notch on the unit release lever is to just contact the edge of the square stud with a 25% minimum bite. To adjust, form the lip on the unit release disabling lever.

ADJ. 6 - SHIFT DISABLING LATCH



With the mult unit escaped one position to delatch the squaring block activating lever, the squaring block sensing link is to raise the shift disabling latch just enough to clear the stud on the shift delay arm bracket. To adjust, form the lip on the latch.

ADJ. 7 - ALIGNMENT OF SELECTON LEVER LINKS



The selection lever links are to be aligned with the activating arms and have approximately .005" to .010" side movement between the collars. Also, the collars are to clear the slots in the selection guide base. To adjust, move the collars.

ADJ. 8 - FEED PAWL ENGAGEMENT & DISENGAGEMENT

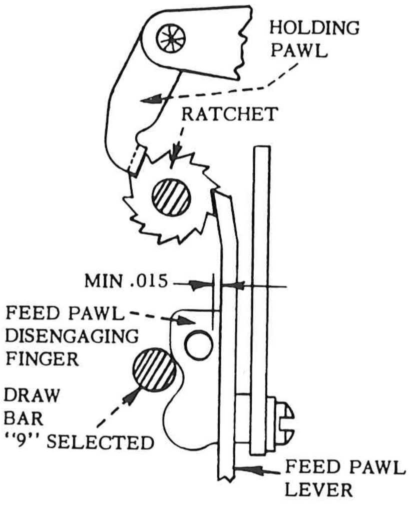


FIG. 1 - ENGAGEMENT

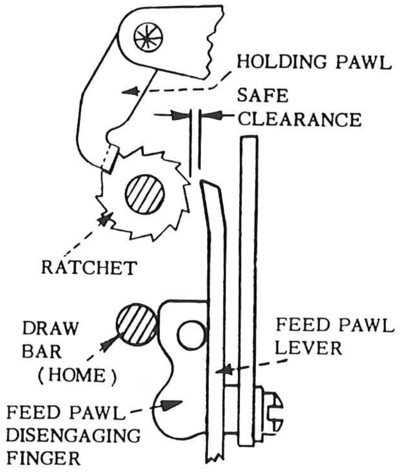
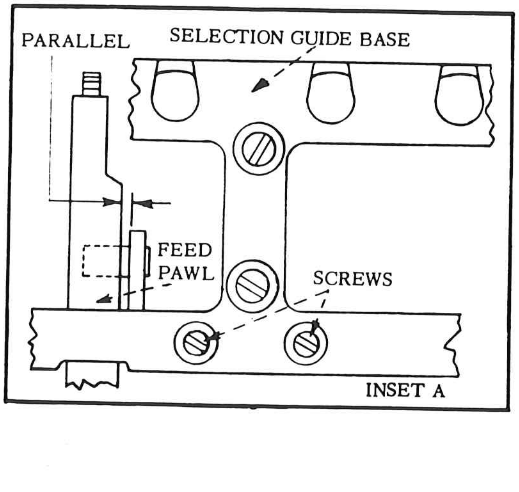


FIG. 2 - DISENGAGEMENT

With the sensing draw bar released to a "9" selection (shortest movement of draw bar), the feed pawl is to engage the ratchet tooth and there is to be a minimum of .015" clearance between the stud on the feed pawl disengaging finger and the feed pawl lever.

With the draw bar in home position and the feed pawl lever manually raised and lowered, the feed pawl is to have safe clearance to the sensing cam shaft ratchet gear and is not to rub against the selection guide base.

To adjust, move the feed pawl disengaging finger as required, but keep it parallel to the feed pawl lever as shown in Inset A.



INSET A

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ADJ. 8 - FEED PAWL ENGAGEMENT & DISENGAGEMENT

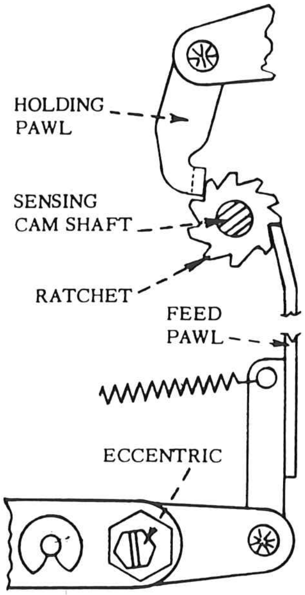
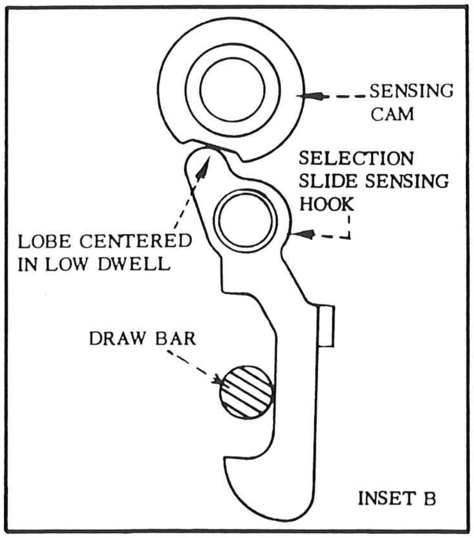


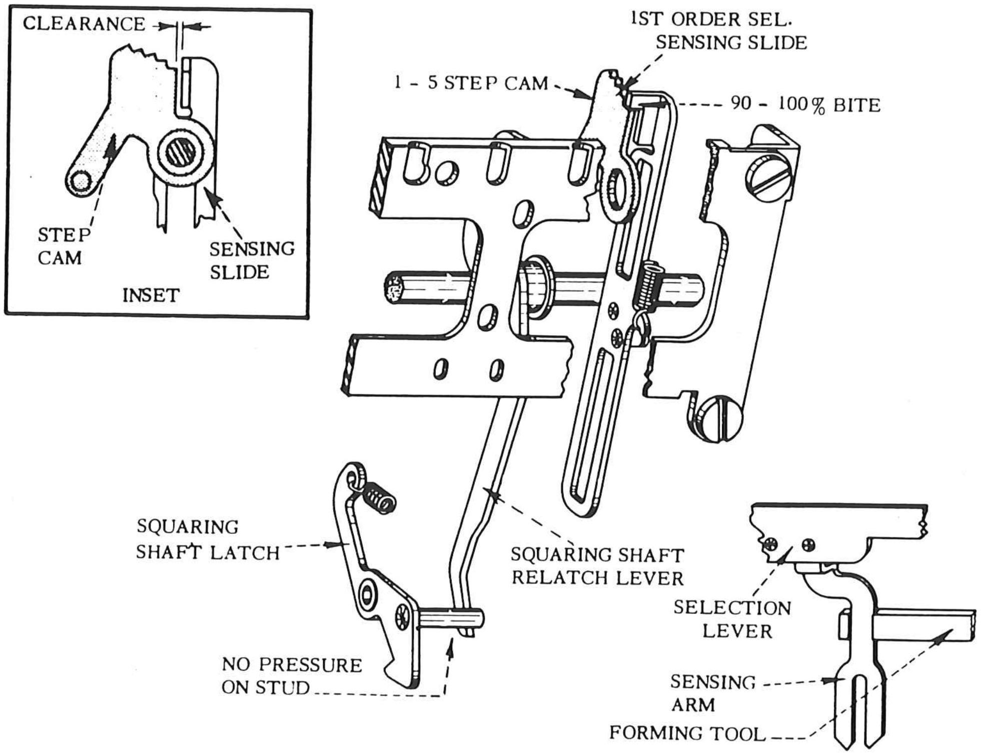
Fig. 3

FIG. 3 - FEED PAWL DRIVE

The full feed movement of the feed pawl and ratchet gear is to rotate the sensing cam shaft so the lobe on the selection slide sensing hook will be approximately centered in the low dwell of its cam as shown in Inset B. Also, the holding pawl is to have a safe over-latch on the ratchet gear tooth. To adjust, turn the eccentric on the feed pawl lever.



ADJ. 9 - SELECTION UNIT AND SELECTION SENSING SLIDES



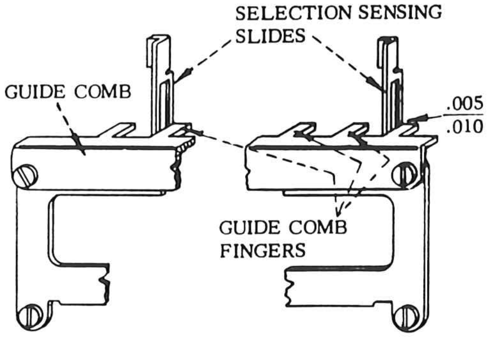
(1) With no selection in the main keyboard and the draw bar released, the selection sensing slides are to have clearance to the underside of the step cams as shown in the Inset.

(2) With numbers selected in the keyboard and the draw bar released, the selection sensing slides are to engage their respective step cam teeth with a 90% to 100% bite.

(3) With the machine in home position, the squaring shaft relatch lever is to have no pressure against the stud on the squaring shaft latch.

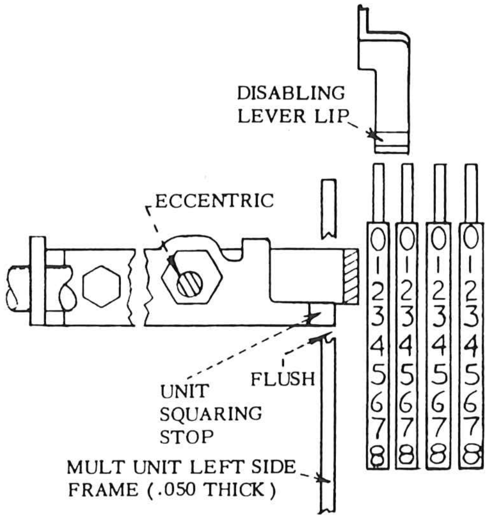
To adjust, move the selection unit up or down as required. Check the engagement on the step cams for 4's and 8's. To obtain the proper engagement on some step cams it may be necessary to form the individual sensing arms.

ADJ. 10 - GUIDE COMB FOR SELECTION SENSING SLIDES



There is to be approximately .005" to .010" clearance between the guide comb fingers and the selection sensing slides. To adjust, move the guide comb right or left as required. Check to see that the slides do not bind when they are moved to the zero position.

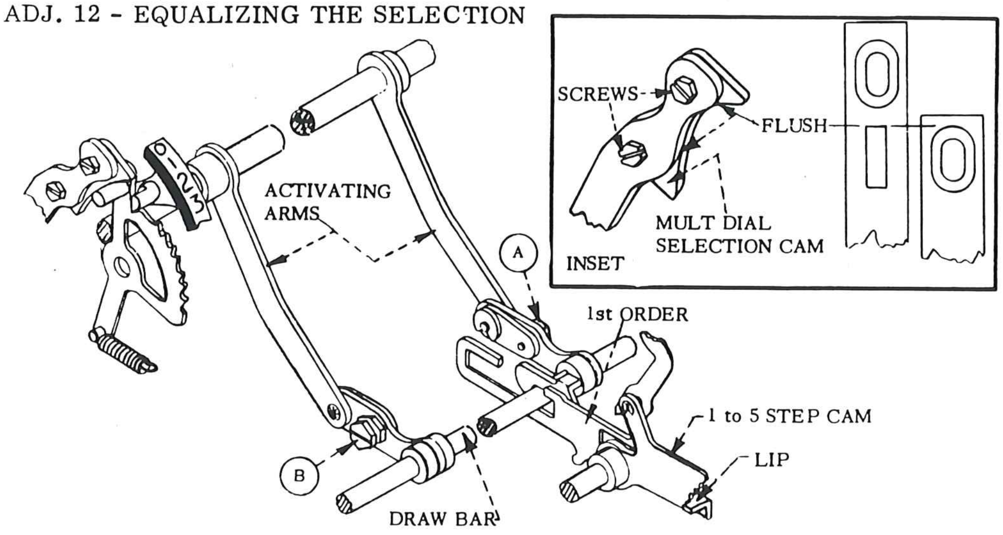
ADJ. 11 - UNIT SQUARING STOP

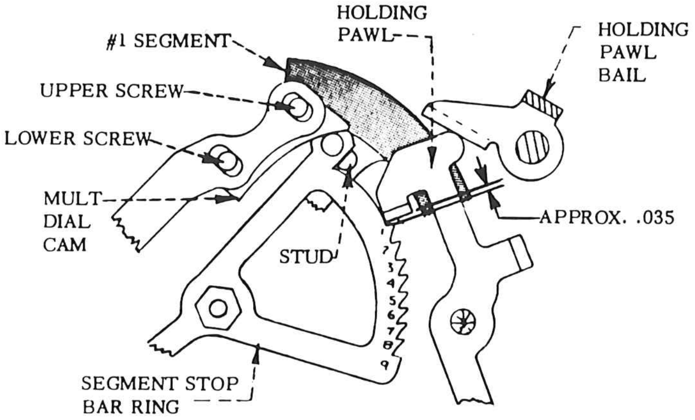


With the mult unit against the squaring stop and the machine manually cycled in squaring, the tooth on the shift barrel is to move in and engage the shift rack tooth with minimum pressure against the shift rack (movement of unit to the left). As a starting point, the stop is positioned so the unit will stop approximately .050" short of two full escapement positions (edge of stop flush with the inside edge of the unit left side frame).

To adjust, escape the mult unit two positions and move the eccentric until the edge of the stop is flush with the inside edge of the unit side frame. To check, cycle the machine in squaring until the shift barrel tooth engages the shift rack tooth. Readjust the stop as required.

ADJ. 12 - EQUALIZING THE SELECTION





To equalize the draw bar movement in relation to the #1 segment for selections in the 1st and 10th keyboard columns, proceed as follows:

(1) Move the mult dial selection cam to the rear so the two points are flush as shown in the Inset.

(2) Select a "1" in the 1st and 10th keyboard columns and cycle the machine in squaring until the #1 mult segment is released against the stud on the stop bar ring. Then turn the eccentric "A" until the top edge of the "1" is aligned with the top edge of the adjacent zeros. Repeat the same procedure for the "1" in the 10th column and adjust eccentric "B".

(3) With the draw bar equalized and using the same selection as above, again cycle the machine in squaring until the #1 mult segment is released against the stop bar ring. Then move the upper end of the mult dial cam to obtain approximately .035" overlatch of the holding pawl to the tooth on the stop bar ring. Check the 10th column to see that it is the same as the 1st column.

(4) Repeat the mult cam adjustment using 8's in the 1st and 10th columns and move the lower end of the mult dial cam to obtain the .035" overlatch.

SQUARING

ADJ. 13 - BLOCKING SEGMENT RELEASE

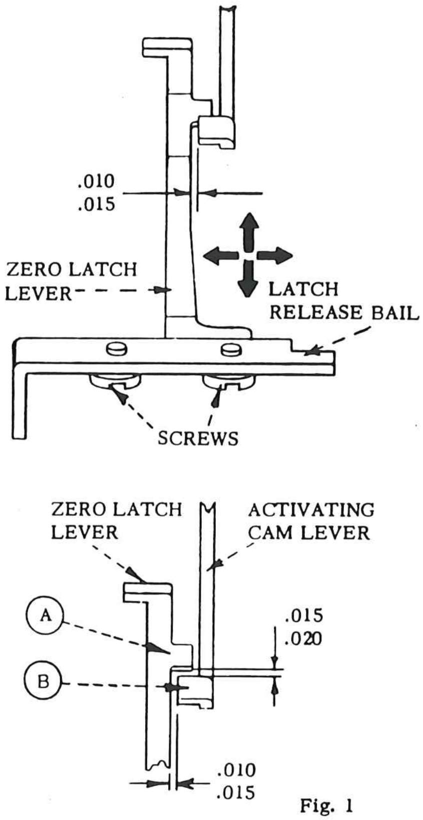


Fig. 1

FIG. 1 - ZERO LATCH LEVER

Lip "A" on the zero latch lever is to block lip "B" on the activating cam lever when "O's" are sensed. But when "1's" are sensed, lip "A" is to clear lip "B" by .015" to .020". To adjust, move the zero latch lever. Keep the latch aligned so there is .010" to .015" clearance between the zero latch lever and lip "B".

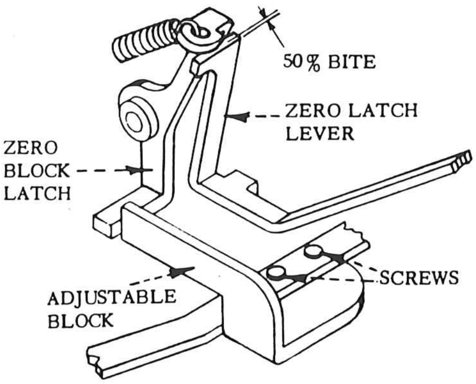


Fig. 2

FIG. 2 - ZERO BLOCK LATCH

With the mult key depressed for squaring and the machine cycled until the unit escapes to the fixed stop, the zero block latch is to engage the zero latch lever with a 50% bite. To adjust, move the adjustable block.

ADJ. 14 - SEGMENT RELEASE

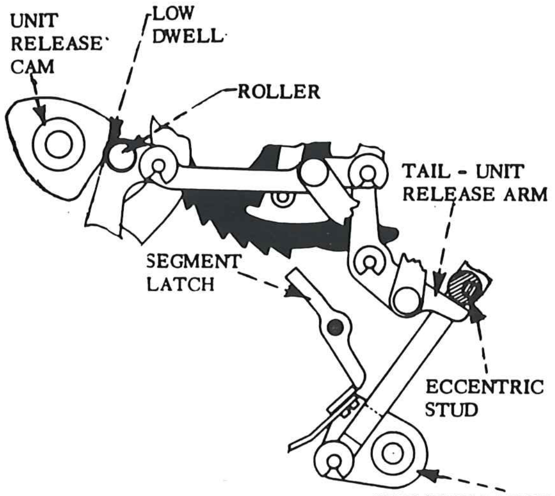


Fig. 1

FIG. 1 - SEGMENT LATCH RELEASE BAIL

With the mult key depressed, cycle the drive shaft until the segment latch release bail is actuated by the tail on the unit release arm contacting the eccentric stud. At this point, the roller on the unit release cam follower is to be in the low dwell of its cam and the segment latch release bail is to move just enough to trip the #1 segment latch and release the first order mult segment. To adjust, move the eccentric as required. Note: If the segment fails to release check to see that the segment latch release bail is not being limited against the eccentric stop washer.

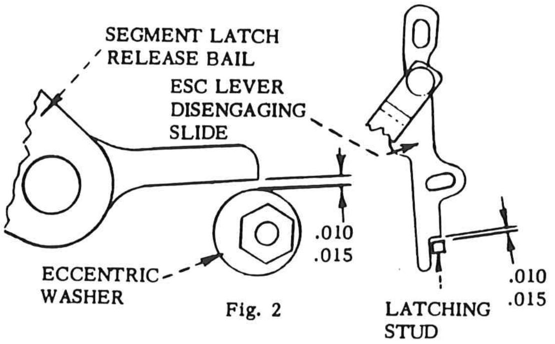


Fig. 2

FIG. 2 - LIMIT FOR ZERO LATCH LEVER

Cycle the machine in squaring until the segment latch release bail is actuated to trip the segment latch (roller on unit release cam follower in low dwell of cam). At this point, there is to be .010" to .015" clearance between the tail on the segment latch release bail and the eccentric washer. To adjust, turn the eccentric washer.

Note: This adjustment must also be checked in repeat mult since there may be a restriction on the relatching of the power set shift lever. Operate the machine in repeat mult until the unit has shifted past home position. At a point just prior to the unit dropping back, check the clearance between the escapement lever disengaging slide and the latching stud on the power set shift lever.

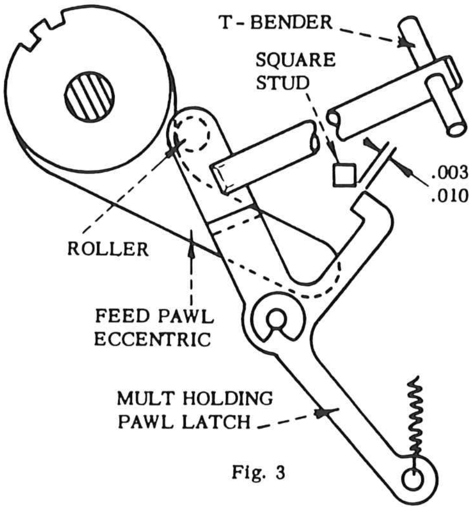


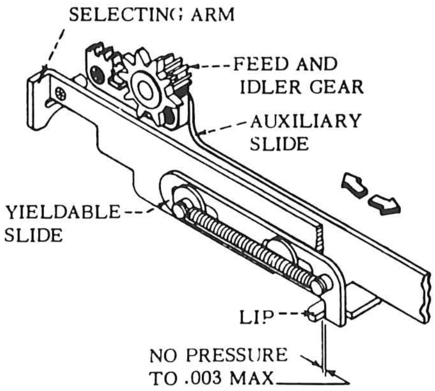
Fig. 3

FIG. 3 - MULT SEGMENT HOLDING PAWL LATCH

When the high point of the feed pawl eccentric has moved the holding pawl latch to its maximum forward travel, there is to be .003" to .010" clearance between the square stud and the holding pawl latch. To adjust, form the latch

SQUARE ROOT

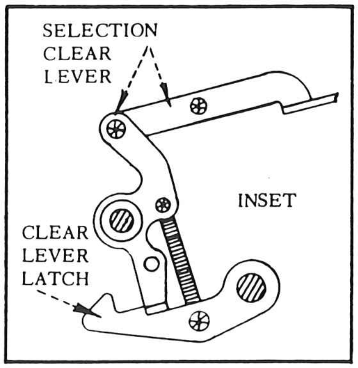
ADJ. 1 - SELECTING ARMS, YIELDABLE SLIDES, & AUXILIARY SLIDES



With the program unit installed and the auxiliary slides perfectly free, the lips on the auxiliary slides must have from no pressure to .003" maximum clearance to the yieldable slides. To adjust, form the lips.

To check the auxiliary slides for freeness, depress the keyboard clear key to latch the selection clear lever (Inset) on the clear lever latch. Then move each auxiliary slide forward and rearward. If any binding or roughness is felt, loosen the holding screws on the program unit and shift the unit until the slides are perfectly free.

Note: There should not be more than .005 up and down movement between the Feed & Idler Gear and the Auxiliary Selecting Arm.



ADJ. 2 - CARRIAGE TIMING

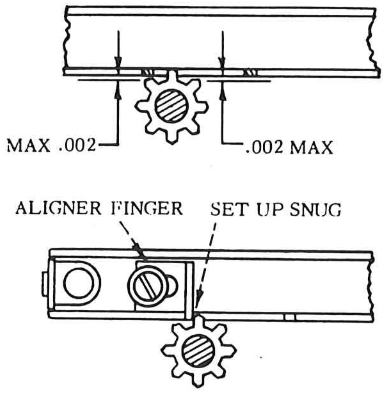


Fig. 1

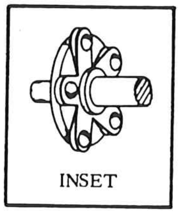


FIG. 1 - REVISED STYLE

Raise or lower the gear box to obtain .002" clearance between the carriage rail and the gear teeth. Then shift the carriage to the extreme right and adjust the aligner finger to just contact the drive gear tooth.

Note: On models with the five leafed detent on the cam shaft (as shown in the Inset), just install the carriage. This style detent automatically times itself.

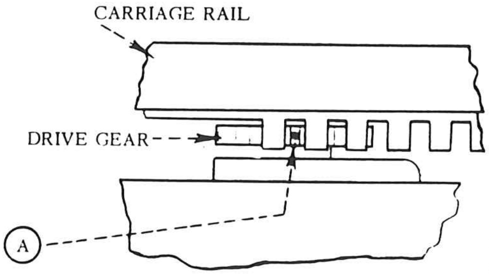


Fig. 2

FIG. 2 - EARLY STYLE

Rotate the drive gear to the right until it stops. Then slide the carriage partially into position and force the gear slightly further to the right so the marked gear tooth A positions into the first tooth opening in the carriage rail when the carriage is moved into engagement with the gear. The carriage is then in time with the square root mechanism. This timing applies to the early style models which have the notched front carriage rail.

ADJ. 3 - ENTRY CONTROL GEAR TIMING

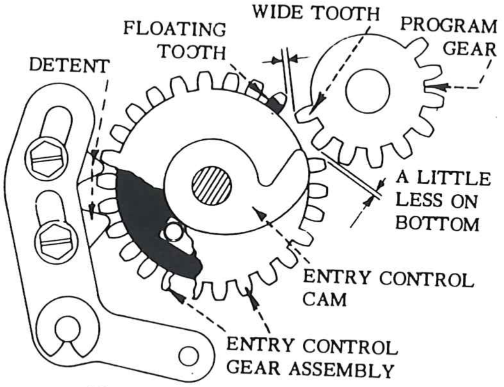


Fig. 1

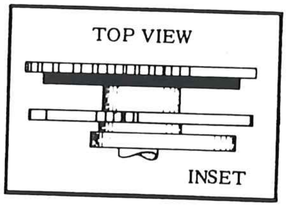


FIG. 1 - ENTRY CONTROL DETENT (REVISED STYLE)

The entry control gear detent is to be set so the wide tooth on the program gear will just clear the teeth on the entry control gear assembly as shown. To adjust, release the clutch and cycle the drive shaft until the teeth on the program gear are in the indicated position. Loosen the detent screws and move the detent to obtain the desired clearance. Test by manually engaging the floating tooth of the black floating tooth disc, with the wide tooth of the program gear. Cycle the drive shaft. The entry control gear assembly is to rotate two tooth spaces and detent properly.

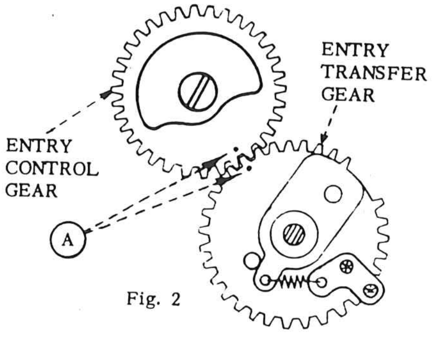


Fig. 2

FIG. 2 - ENTRY CONTROL GEAR (EARLY STYLE).

When installing these gears, align punch marks A for proper timing.

ADJ. 4 - STARTING SHAFT

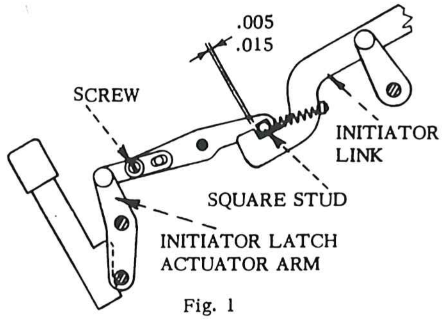


Fig. 1

FIG. 1 - INTIATOR LATCH

In home position there is to be .005" to .015" clearance between the square stud and the initiator link. To adjust, move the initiator latch actuator arm as required.

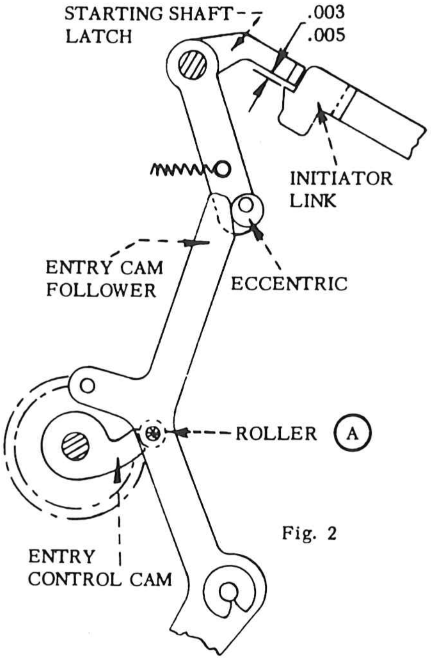


Fig. 2

FIG. 2 - STARTING SHAFT RELATCHING

(Revised Style)

With roller A positioned on the high point of the entry control cam the starting shaft latch is to overlatch the initiator link .003" to .005". To adjust, turn the eccentric as required. Note: On some models if there is too much overlatch, the starting latch will contact the top cover.

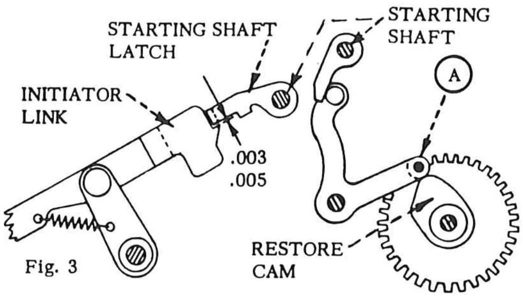


Fig. 3

FIG. 3 - STARTING SHAFT RELATCHING

(Early Style)

With roller A positioned on the high point of the restore cam the starting shaft latch is to overlatch the actuator link .003" to .005". To adjust, form the starting shaft latch. Note: If there is too much overlatch, the starting shaft latch will contact the top cover.

Continued on next page

ADJ. 4 - STARTING SHAFT

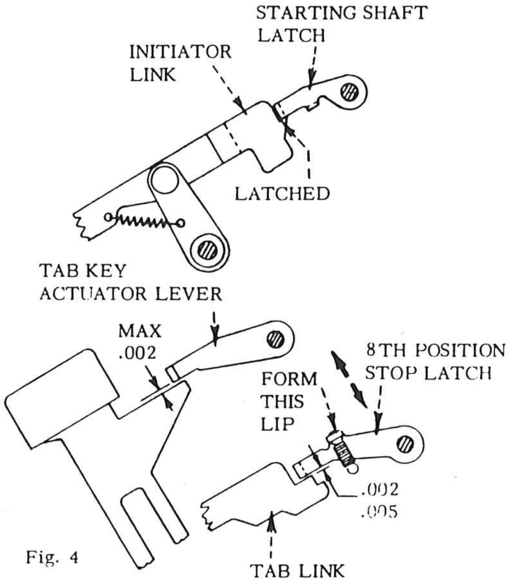


Fig. 4

FIG. 4 - TAB KEY ACTUATOR LEVER & 8th POSITION STOP LATCH

When the starting shaft latch is latched on the initiator link, there is to be .002" clearance between the tab key actuator and the enter dividend key. To adjust, form the tab key actuator lever.

Also, there is to be .002" to .005" clearance between the 8th position stop latch and the tab link. To adjust, form the spring lip on the stop latch.

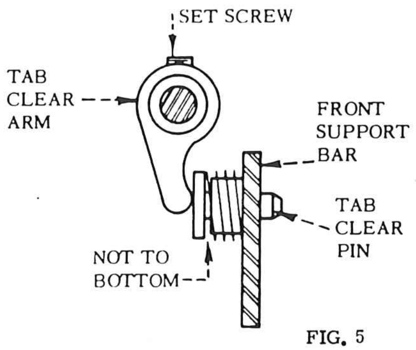
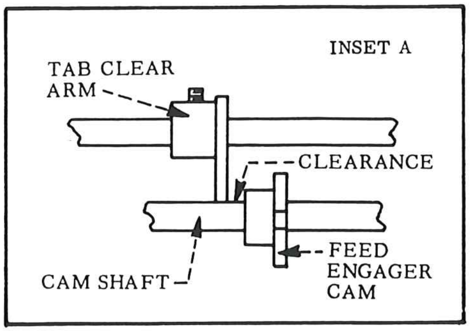
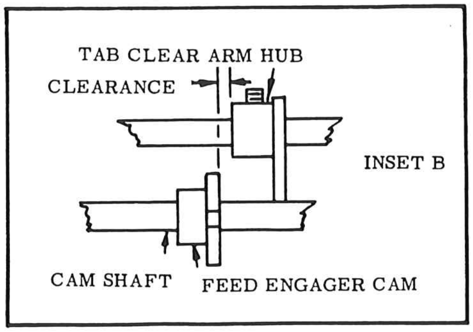


FIG. 5

FIG. 5 TABULATOR CLEAR PIN
(Revised Style)

With the starting shaft tripped off, the clear pin is to move to the rear but is not to bottom on the hub. When the starting shaft is latched, the point of the clear pin is not to protrude from the front support bar. When the carriage is in home position and the starting shaft is tripped, the clear pin is to release any depressed tab keys. To adjust, rotate the tab clear arm as required. After adjusting check to see that the tab clear arm has clearance to the feed engager cam (as shown in Inset A) when the starting shaft is restoring and cam shaft has not been actuated to the right. With the cam shaft actuated all the way to the right, there is to be clearance between hub of tab clear arm and feed engager cam (as shown in Inset B).





ADJ. 4 - STARTING SHAFT

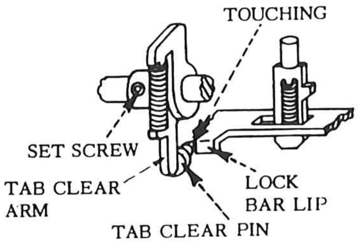


Fig. 6

FIG. 6 - TABULATOR CLEAR PIN (Early Style)

When the carriage is in first position, the beveled end of the tab clear pin is to contact the lock bar lip with slight pressure. To adjust, rotate the tab clear arm as required.

Note: Too much pressure will release the tab keys in normal tabulation. Too much clearance will not allow the tab clear pin to release the tab keys in square root operation.

ADJ. 5 - ENTRY CONTROL LATCH

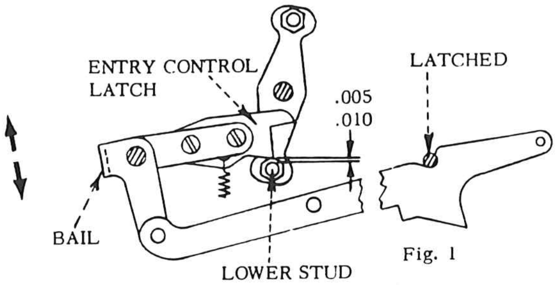


Fig. 1

FIG. 1 - HOME POSITION (Early Style)

With the machine in home position, the entry control latch is to clear the lower stud by .005 to .010. To adjust, form the bail.

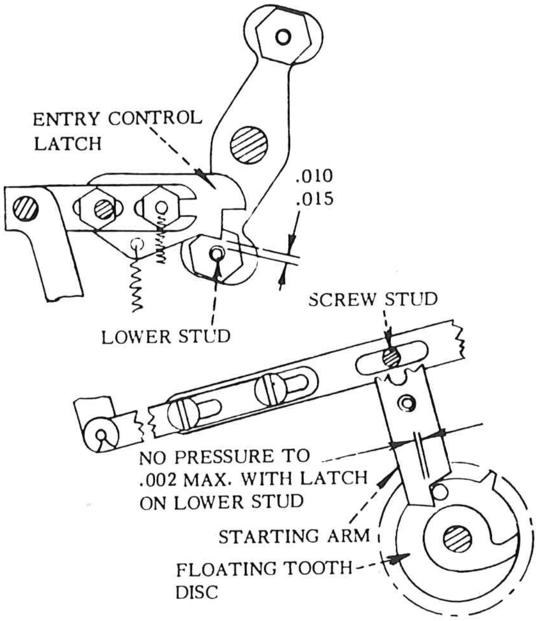


Fig. 2

FIG. 2 - HOME POSITION (Revised Style)

(1) With the starting shaft latched in home position, there is to be .010" to .015" clearance between the entry control latch and the lower stud. To adjust, loosen screws A and slide the link as required.

(2) Trip the starting shaft so the entry control latch rests on top of the lower stud. The entry gear starting arm is to have a maximum of .002" clearance to the stud of the floating tooth disc, but without pressure against the stud. To adjust, loosen the screw stud and move as required.

Continued on next page

ADJ. 5 - ENTRY CONTROL LATCH

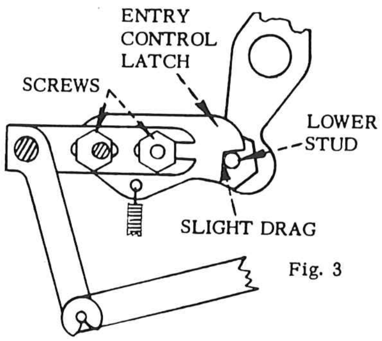


Fig. 3

FIG. 3 - ENTRY POSITION (Early and Revised)

With the machine in home position and both the starting shaft and the gate setting lever tripped, the entry control latch is to drop against the rear side of the lower stud with a slight drag. To adjust, move the entry control latch.

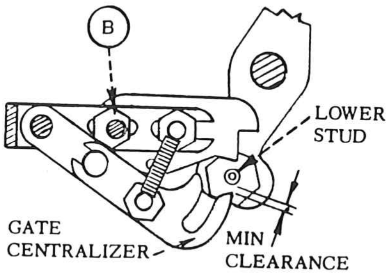


Fig. 4

FIG. 4 - GATE CENTRALIZER (Plus Position)

With the add-subtract gate in the plus position, there is to be minimum clearance (but not touching) between the lower stud and the gate centralizer. To adjust, turn the eccentric B as required. Note: No adjustment provided on early models without the eccentric B.

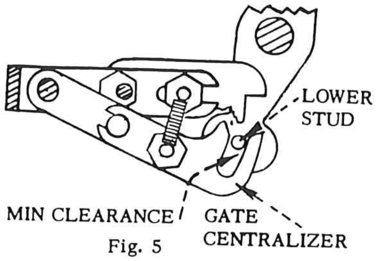


Fig. 5

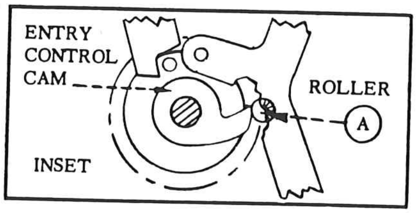


FIG. 5 - GATE CENTRALIZER (Shift Position)

Cycle the machine in square root until roller A (Inset) reaches the high point of the entry control cam. Then as the gate moves to the neutral (centralized) position, the gate centralizer is to straddle the lower stud with minimum clearance to the front side of the stud. To adjust, move the centralizer.

ADJ. 6 - SHIFT LINK AND ENTRY LINK

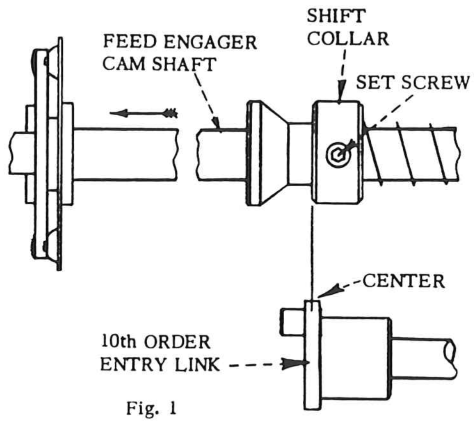


Fig. 1

FIG. 1 - CAM SHAFT SHIFT COLLAR

When the feed engager cam shaft is to the extreme left, the shift collar is to align with the 10th order entry link as shown. To adjust, move the shift collar right or left as required. Note: The set screw must not protrude above the shift collar.

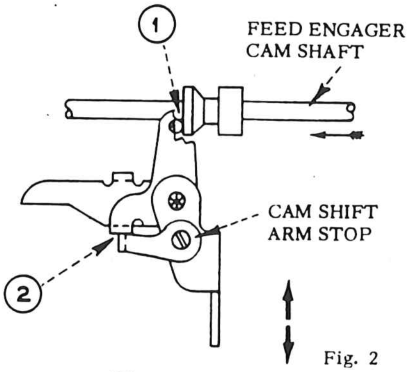


Fig. 2

FIG. 2 - CAM SHIFT ARM STOP

When the feed engager cam shaft is to the extreme left, the shift arm stop is to be adjusted for no pressure or lost motion at points (1) and (2).

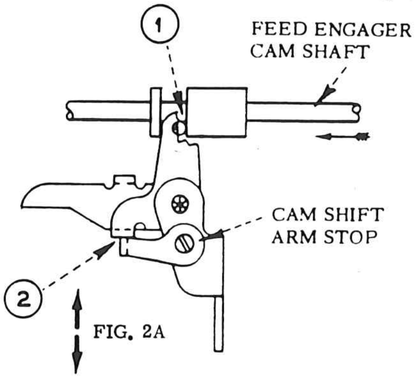


FIG. 2A

FIG. 2A CAM SHIFT ARM STOP

When the feed engager cam shaft is to the extreme left, the shift arm stop is to be adjusted so the cam shift arm will have .002" to .003" movement between points 1 and 2.

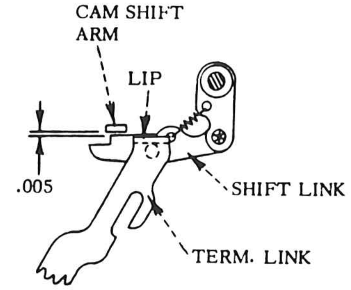


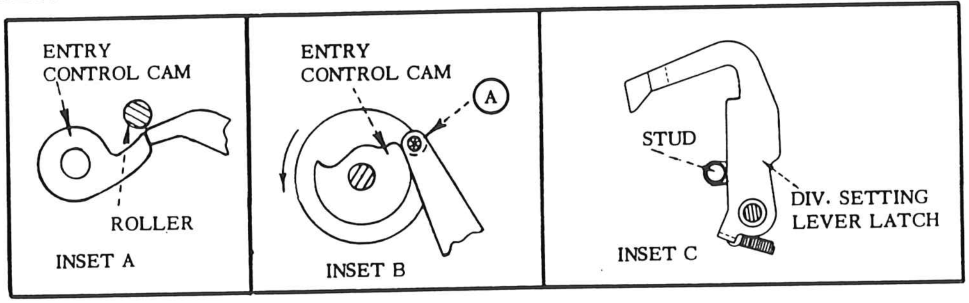
Fig. 3

FIG. 3 - CLEARANCE BETWEEN SHIFT LINK AND CAM SHIFT ARM

With the machine in home position there is to be .005" clearance between the cam shift arm and the shift link. To adjust, form the lip on the termination link.

Continued on next page

ADJ. 6 - SHIFT LINK AND ENTRY LINK



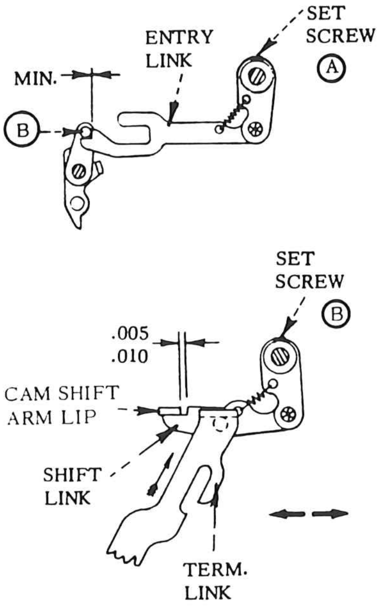


Fig. 4

FIG. 4 - ENTRY CYCLE POSITION OF ENTRY LINK AND SHIFT LINK

With the machine cycled in square root until the add-subtract gate is positioned for entry cycles; the extension on the program starting arm (revised style) or the roller A (early style) is on the high point of the of the entry control cam; and the division setting lever latch is delatched (See Insets A, B and C), there is to be:

(A) Minimum clearance between the notch on the entry link and stud "B".

(B) .005" to .010" clearance between the lip on the cam shift arm and the shift link.

To adjust, loosen the set-screw "A" and rotate the entry link as required. Then loosen the set-screw "B" and rotate the shift link as required.

Note: Check to see that both the entry link and the cam shift link have sufficient spring tension.

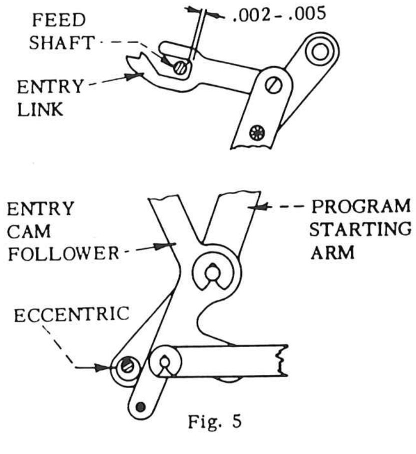


Fig. 5

FIG. 5 - ENTRY LINK CLEARANCE TO FEED SHAFT

With the machine in "home" position the entry link is to clear the feed shaft by .002" to .005". To adjust, turn the eccentric as required.

Continued on next page

ADJ. 6 - SHIFT LINK AND ENTRY LINK

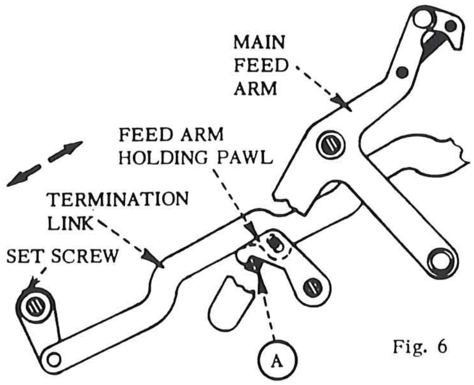
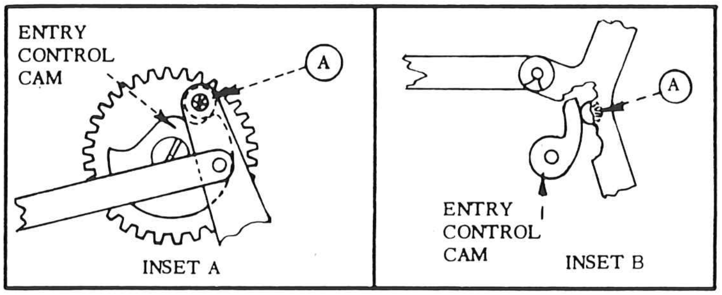


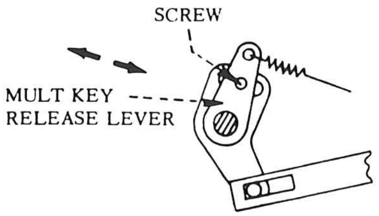
Fig. 6

FIG. 6 - TERMINATION LINK

With the machine in home position, the termination link is to hold the feed arm holding pawl against stud A of the main feed arm. To adjust, loosen the set-screw and move the termination link.

ADJ. 7 - RELEASE OF ENTER DIVIDEND KEY





With the keyboard clear, cycle the machine in square root until the add-subtract gate is positioned for the first entry cycle. The enter dividend key must release when roller A is approximately half way up the entry control cam (during the 5th entry cycle) as shown in Inset A or Inset B. To adjust, loosen the screw and move the mult key release lever. Note: Do not change the mult key release adjustment.

ADJ. 8 - ENGAGEMENT AND DISENGAGEMENT OF FEED AND IDLER GEARS

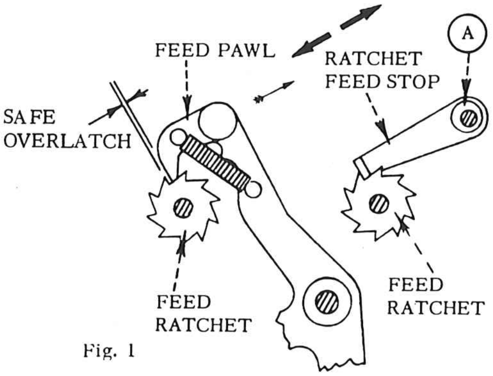


Fig. 1

FIG. 1 - RATCHET FEED STOP

Cycle the machine with the plus key depressed. When the feed pawl reaches its maximum rearward travel there is to be a safe overlatch of the feed pawl to the feed ratchet tooth. To adjust, rotate eccentric A. Note: Too much clearance will not allow the feed and idler gear to rotate far enough for the holding pawl to engage. Too little clearance may cause a failure of the feed pawl to overlatch the feed ratchet in a square root operation.

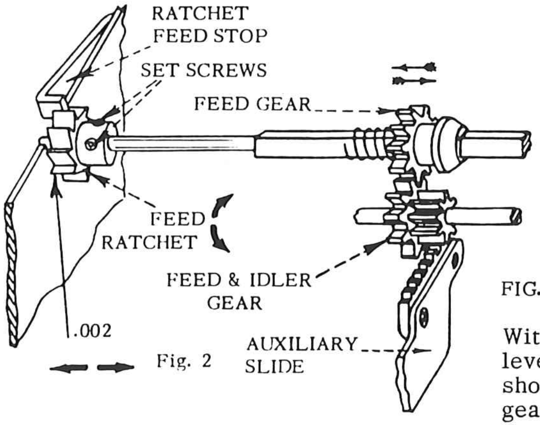


Fig. 2

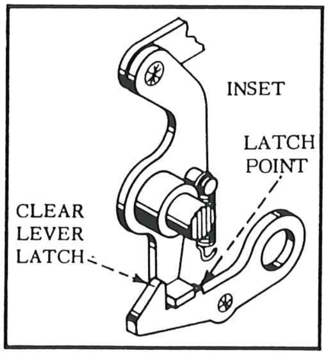


FIG. 2 - FEED RATCHET AND FEED GEAR SHAFT

With the machine in home position; the clear lever latch delatched from latch point as shown in the Inset; and the feed ratchet gear held against the ratchet feed stop; the feed gears must be free to engage and disengage with the feed and idler gears. To adjust, loosen the set-screws and rotate the feed gear shaft as required. Before tightening the set-screws check for .002" clearance between the feed ratchet and the side frame.

ADJ. 9 - KEYBOARD CLEARING

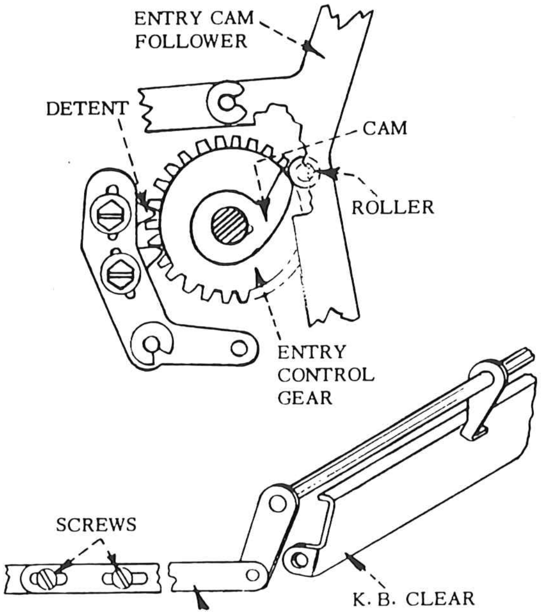


Fig. 1

FIG. 1 - REVISED STYLE

With all 1's entered on the main keyboard, cycle the machine in square root until the 4th entry cycle has registered in the accumulator dials. Continue to cycle the drive shaft slowly until the 5th entry cycle has completely registered in the accumulator dials and the entry control gear has stopped rotating. At this point (roller on high point of entry control gear) the selection keys must be released and clear of their lock bars. To adjust, move the link. Note: If the keyboard clear gate bottoms, it will be necessary to slack off on the adjustment slightly to prevent straining or binding the parts.

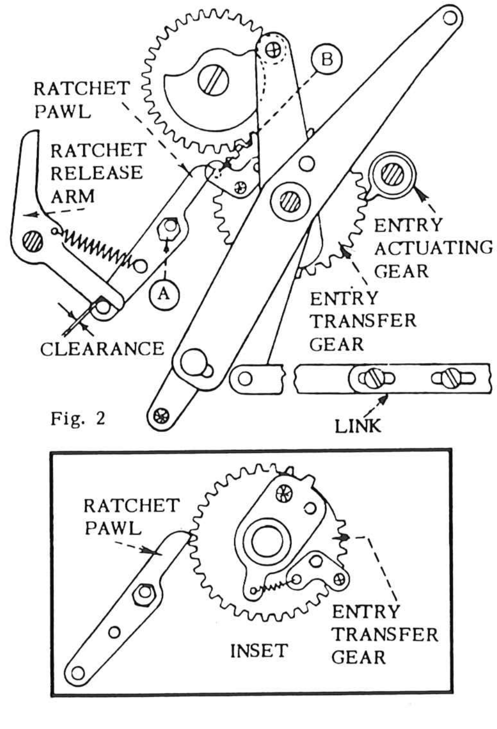


Fig. 2

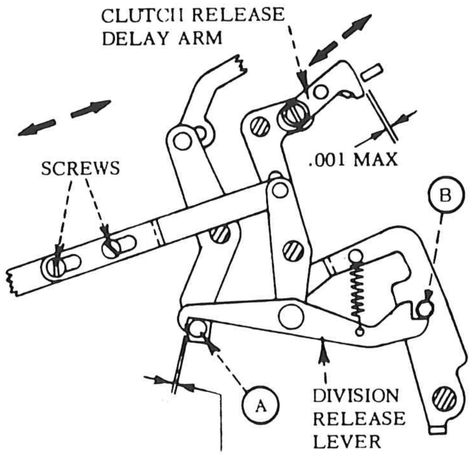
FIG. 2 - EARLY STYLE

(1) With all 1's entered on the main keyboard, cycle the machine in square root until the add-subtract gate is positioned for entry cycles. Continue to cycle the drive shaft slowly until the entry transfer gear is positioned as shown in the Inset and the entry actuating gear is still engaged. At this point all selection keys must be released and clear of their lock bars. To adjust, move the link but do not bottom the keyboard clear gate.

(2) While the entry actuating gear and the entry transfer gear are still in the position indicated, stud B is to cause the ratchet pawl to overlatch the ratchet release arm with sufficient clearance. To adjust, turn eccentric A.

(3) Restore the entry transfer gear to home position. The ratchet pawl (Inset) is to position into a tooth space.

ADJ. 10 - DELATCHING DIVISION



REVISED STYLE ---.005 to .010
EARLY STYLE ---- Max. .001

Fig. 1

FIG. 1 - DIVISION RELEASE LEVER

(1) Cycle the machine in square root until the parts are positioned for keyboard clear (as described in Adj. 9). On revised style machines the division release lever is to drop over stud A with .005" to .010" clearance. On early style machines, there is to be a maximum of .001" clearance. To adjust, move the link as required. Note: The rear of the division release lever is to engage stud B.

(2) While the machine is still positioned as above, there is to be .001" maximum clearance between the clutch release delay arm and the extension on the shift contact levers assembly (crows foot). To adjust, move the clutch release delay arm as required.

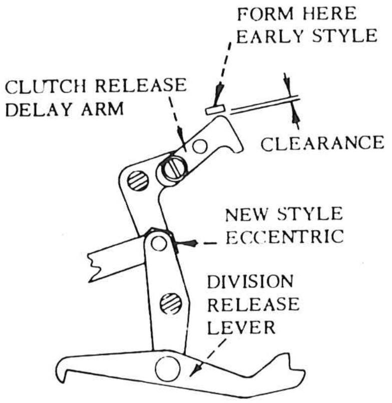


Fig. 2

FIG. 2 - CLUTCH RELEASE DELAY ARM & SHIFT CONTACT LEVERS

With the machine in home position, the clutch release delay arm is to have clearance to the underside of the extension of the shift contact levers assembly (crows foot). To adjust revised style, turn the eccentric as required. Early style, form the extension.

ADJ. 11 - FEED ENGAGER CAMS

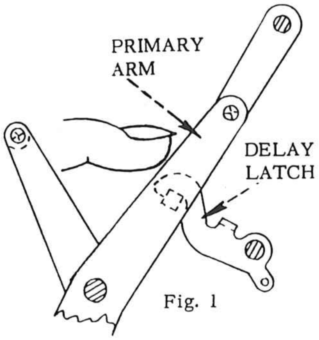


Fig. 1

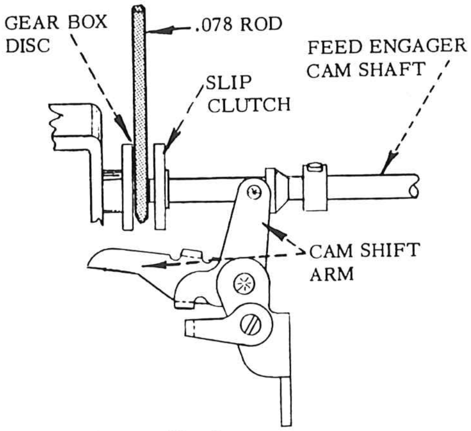


Fig. 2

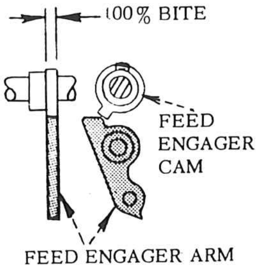


Fig. 3

The feed engager cams are to be positioned on the feed engager cam shaft as follows:

1. Have the machine in home position and the carriage to the extreme right.
2. Loosen the cams and move them to the left just enough to prevent restricting the movement of the feed engager cam shaft.
3. On revised style machines, pull the program starting arm forward and then release it. On early style machines, latch and delatch the primary arm (Fig. 1).
4. Insert a .078" drill rod (or use part #84528) between the end of the feed engager cam shaft and the gear box disc (Fig. 2). Then position the lug on the #10 cam against the feed engager arm with a 100% bite. (Note: The .078" rod is used only for precise positioning of the feed engager cam shaft while setting the #10 feed engager cam. The #10 and #9 cams are set for a 100% bite as shown in Fig. 3.) The remaining cams are set for approximately 90% engagement.
5. The remaining cams are set without the .078" rod, but before removing the rod move the cam shift arm rearward and keep it held rearward while setting the remaining cams.
6. Check the #10 cam for a positive "5" entry by depressing the plus bar. If a "4" or any number other than "5" is registered, then readjust the cam.
7. Shift the carriage one position to the left; adjust the #9 cam and check the "5" entry.
8. Again shift the carriage one position to the left and set the #8 cam. Repeat this procedure until each cam is adjusted and checked for a positive "5" entry.
9. When the cams are adjusted for correct engagement and positive "5" entry, shift the carriage right and left and check for safe clearance between the cam lugs and the feed engager arms.
10. Test the machine in square root for the initial "5" entry and for correct operation of the feed engager cams. Also check for safe clearance between the slip clutch detent balls and the 2025 screw in the detecting lever #45397.

ADJ. 12 CAM ALIGNMENT

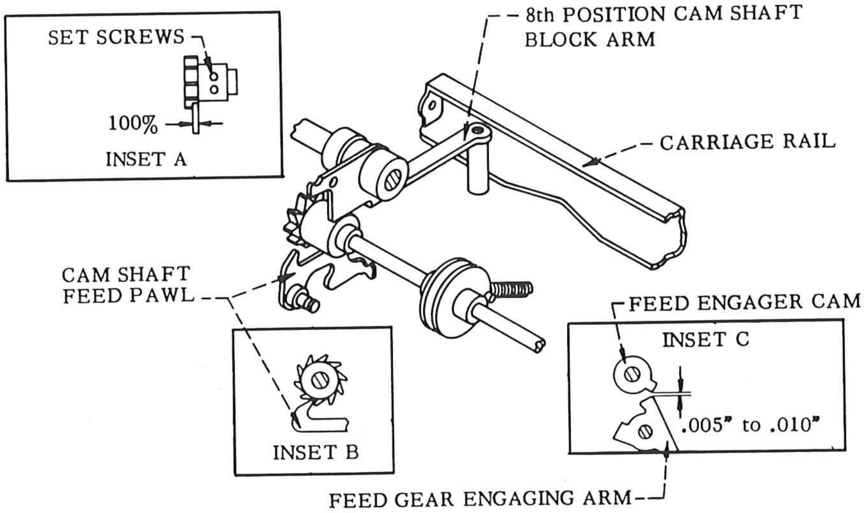


FIG. 1 CAM SHAFT FEED PAWL

FIG. 1

Depress a right square root key and cycle the drive shaft until the feed engager cam shaft is fully positioned to the right at this point the cam shaft feed pawl is to have 1. 100% engagement with the feed ratchet as shown in inset A. 2. Cycle the drive shaft until the cam shaft feed pawl is on its maximum rearward movement at this point the #1 feed engager cam is to have .005" to .010" overlatch to the feed gear engaging arm as shown. Adjust for both conditions with the set screws.

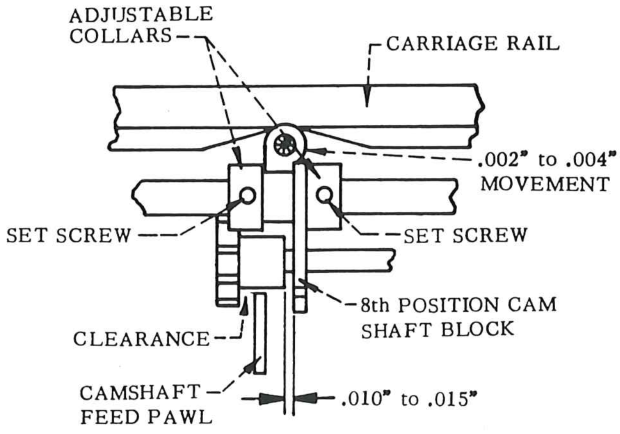


FIG. 2

FIG. 2 8th POSITION CAM SHAFT BLOCK

With the carriage positioned so the notch in the carriage rail allows the 8th position cam shaft block to pivot into the blocking position the 8th position cam shaft block is to have .010" to .015" clearance to the edge of the hub on the cam shaft feed ratchet. Adjust by moving the adjustable collars right or left, also be sure to maintain .002" to .004" lateral movement in the 8th position cam shaft block.

Note: After adjusting depress a left square root key and cycle the drive shaft until the cam shaft is moved against the 8th position cam shaft block. At this time there must be clearance between the cam shaft feed pawl and the ratchet gear as shown.

FRIDEN CALCULATOR ADJUSTMENTS

SQUARE ROOT

ADJ. 12 CAM ALIGNMENT

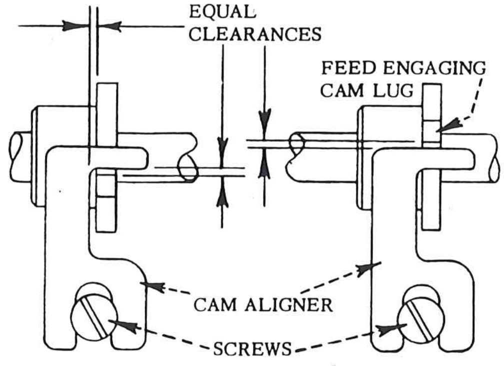
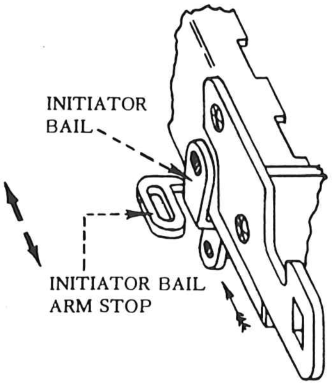


FIG. 3 CAM ALIGNER

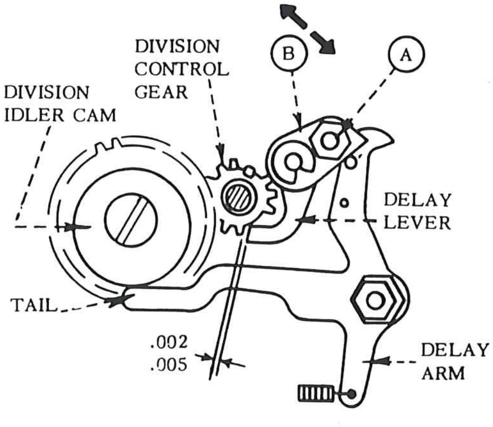
Shift the carriage to the extreme right and then to the extreme left and adjust the cam aligner for equal clearance to the feed engager cam lug as shown.

ADJ. 13 - INITIATOR BAIL



Depress and hold down any square root key and move the initiator bail arm stop against the initiator bail.

ADJ. 14 - DELAYING LEVER FOR CONTROL GEAR



Depress the plus key and cycle the drive shaft until the high point of the division idler cam is down. At this point there is to be .002" to .005" clearance between the delay lever and the tooth of the division control gear. To adjust, loosen screw stud A and pivot the adjustable arm B up or down for the desired clearance. Note: On models without this adjustable means, form the tail of the delay arm.

USE OF TOOLS

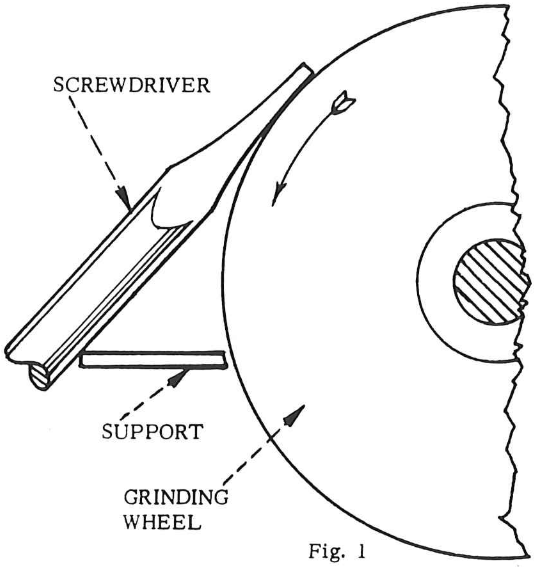


Fig. 1

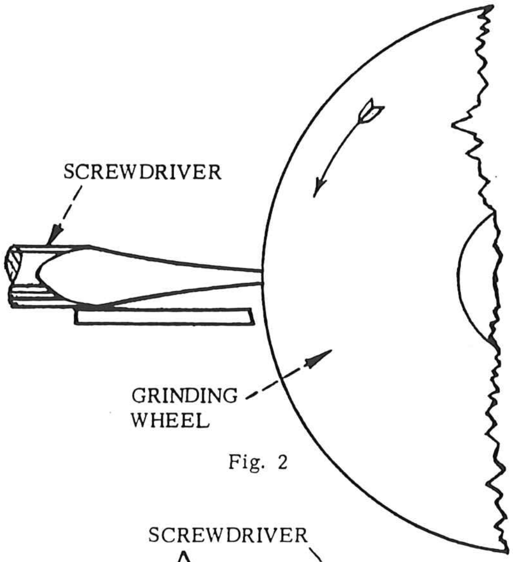


Fig. 2

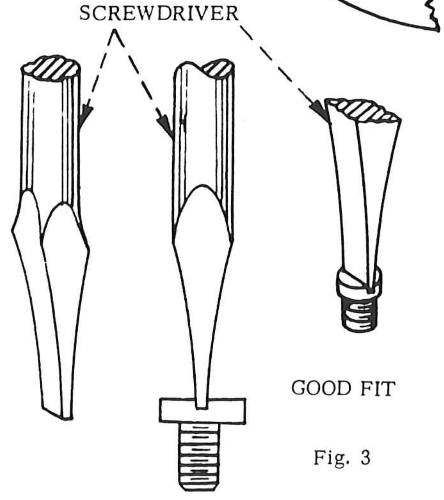


Fig. 3

FIGS. 1, 2 & 3

Your screwdriver should always be in good condition. The bit must fit the slot in the screwhead so it will not slip while loosening or tightening a screw (Figure 3). A screwdriver is never to be used as a punch. The bit will be damaged or burred so it will not perform properly. Screwdrivers should be sharpened whenever they become dull. Make it a practice to check and sharpen yours every week. Have your instructor show you how.

DO NOT BURN your screwdriver and destroy its temper by holding it tightly against a grinding wheel. Cool it frequently by dipping it into cold water. Figure 1 shows how to hold the screwdriver against the grinding wheel by resting it on the support - screwdriver resting against the wheel flat and square. Figure 2 shows how to square off the end of the screwdriver.

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USE OF TOOLS

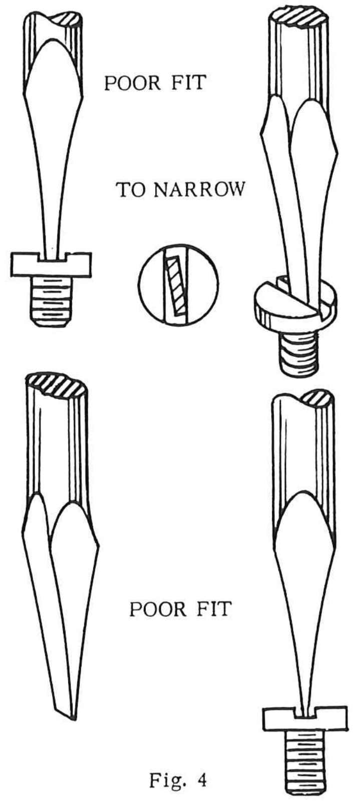


Fig. 4

FIGURE 4

Use the proper size screwdriver - never use a thin or narrow bit screwdriver to remove a heavy screw. Not only will the screw be difficult to remove, it will be damaged and the screwdriver can be ruined.

WARNING: A screwdriver can produce a painful injury if it should slip off the screw and jab your hand. Never have your free hand in a position where it can be jabbed should the screwdriver slip.

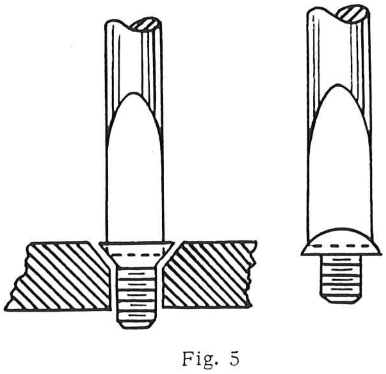


Fig. 5

FIGURE 5

For flat or oval head screws the bit must not project out from the slot.

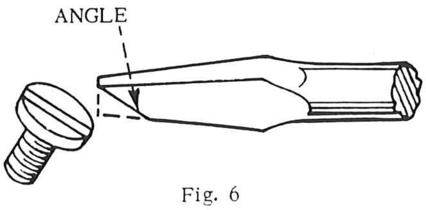


Fig. 6

FIGURE 6

A screwdriver used at an angle will not seat in the screw slot properly and the screw head will be damaged. A screwdriver ground at an angle will work much better.

USE OF TOOLS

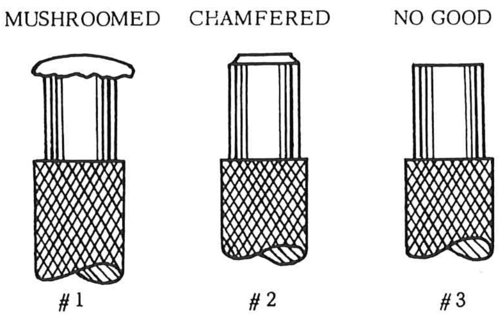


Fig. 1

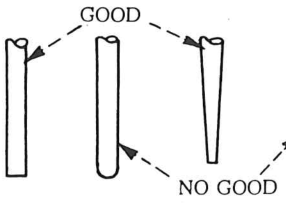


Fig. 2

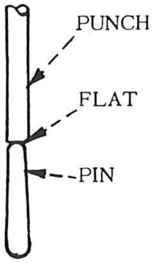


Fig. 3

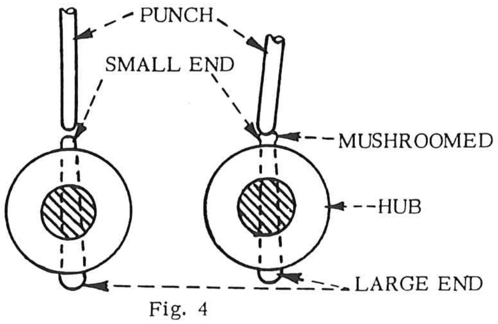


Fig. 4

Since a large number of parts are attached by taper pins, it is well to know something about them. It is very important to determine, by observation, which is the large or small end before attempting to drive the pin OUT. As you progress with the disassembly of the machine, make notes and sketches of the pins and the proper method to drive the pin out.

FIGURE 1

When a punch becomes mushroomed from being hit with a hammer (as shown on Punch #1), grind off the burrs and chamfer the edge. Chamfering the edge (as shown on Punch #2) will prevent a glancing hammer blow from chipping the edges of the punch (the eye is always a good target for flying chips). Punch #3 is no better than Punch #1. It will still chip.

FIGURE 2

Your punches must be in good condition to properly drive a pin in or out. The punch end of a driving punch or a taper punch must be flat. The driving punch is straight and the taper punch has a taper at the end used for follow up when driving a pin out.

FIGURE 3

Since the end of a taper pin is round - the punch must be flat and no smaller than the pin end.

FIGURE 4

A round end punch will mushroom the pin and make it difficult to remove.

Continued On Next Page

USE OF TOOLS

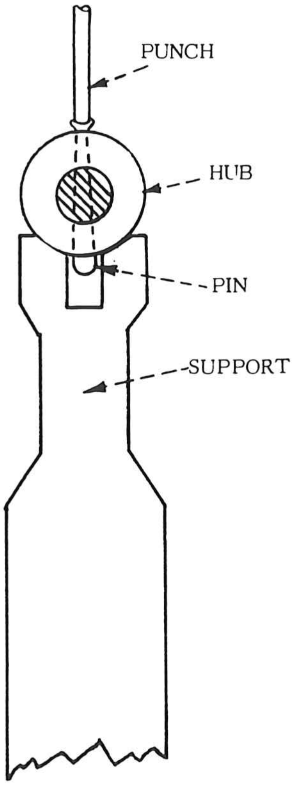


Fig. 5

FIGURE 5

When driving out a pin, make sure the part is properly supported. Use the correct size punch and one that is in good condition. Steady the punch on the pin end and give the punch a good "wallup" with the hammer. This first hammer blow is most important in driving a pin. Do not tap the punch lightly for this tends to mushroom the end of the pin.

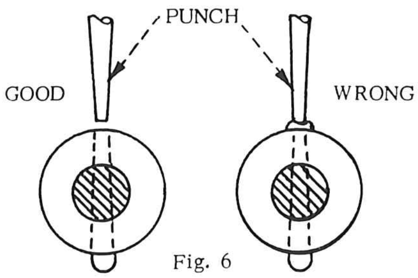


Fig. 6

FIGURE 6

If the small end of the pin is not extending through the surface or is flush with it, use a tapered punch to drive the pin. The end of the tapered punch is to be flat. Do not try to drive a pin with the tapered punch if the pin is protruding above the surface of the part. To do so will mushroom the end of the pin and may damage the hub on the part.

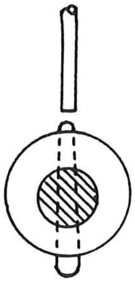


Fig. 7

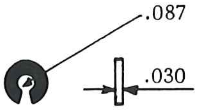
FIGURE 7

If the small end of the pin is protruding above the surface, use a straight punch first. This will prevent mushrooming the end of the pin. After the small end has been driven below the surface of the part, then use a tapered punch to remove the pin.

If a pin should mushroom when attempting to drive it out, do not keep on hammering it. File the damaged end and start again. If the end is filed flush with the surface of the part, use the taper punch - but - observe very carefully before driving because the pin becomes blended into the surface of the part and is quite difficult to distinguish. It is wise to drive the pin in a little from the large end to distinguish the exact outline of the pin. This also will make the pin easier to remove.

COMMON USAGE CLIPS & KEEPERS

NYLON



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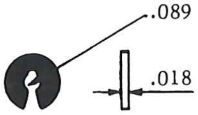

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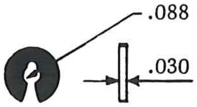

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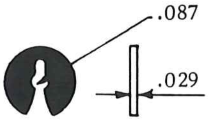

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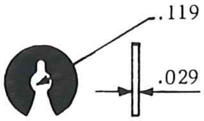

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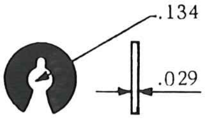

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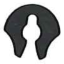
METAL



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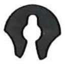

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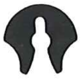

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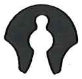

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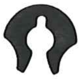

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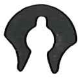

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WIRE

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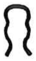

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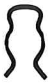

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TRUARC

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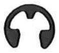

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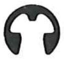

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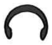

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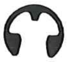

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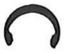

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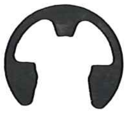

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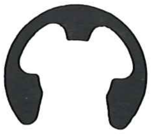

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NOTES:

REMOVAL OF MAIN KEYBOARD (Standard Models)

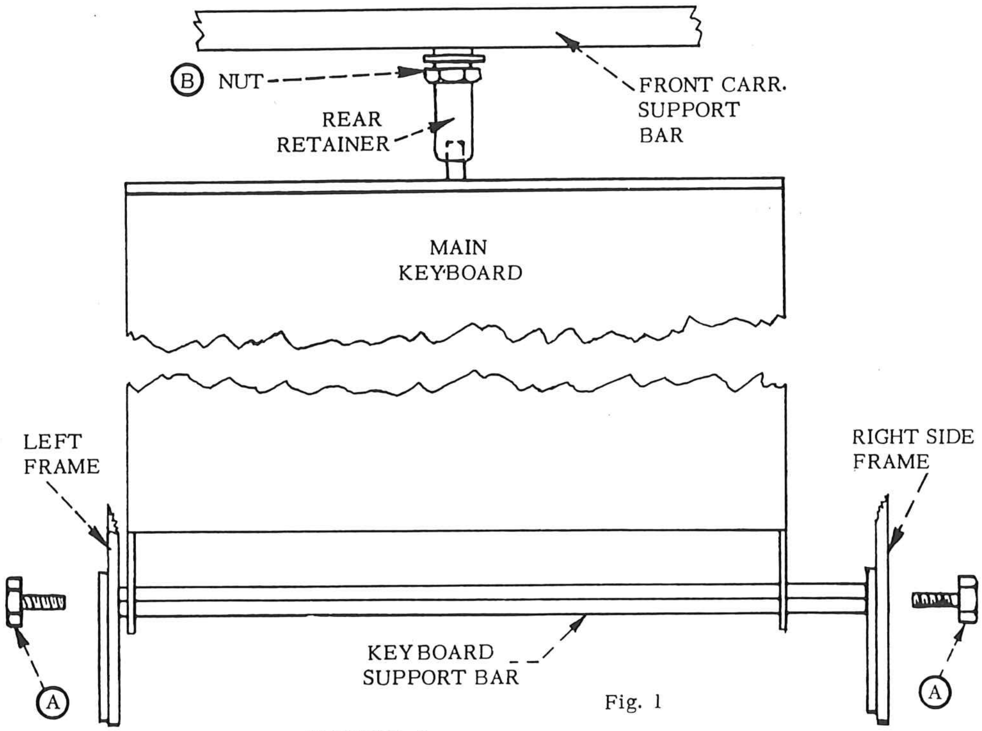


FIGURE 1

(1) Remove screws A.
(2) Loosen screw B and rotate rear retainer.
(3) Lift out keyboard.

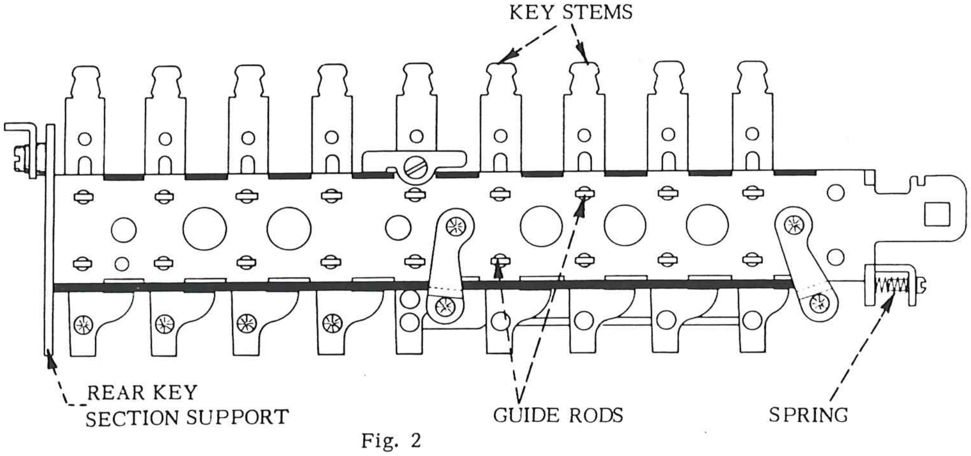


Fig. 2

FIGURE 2

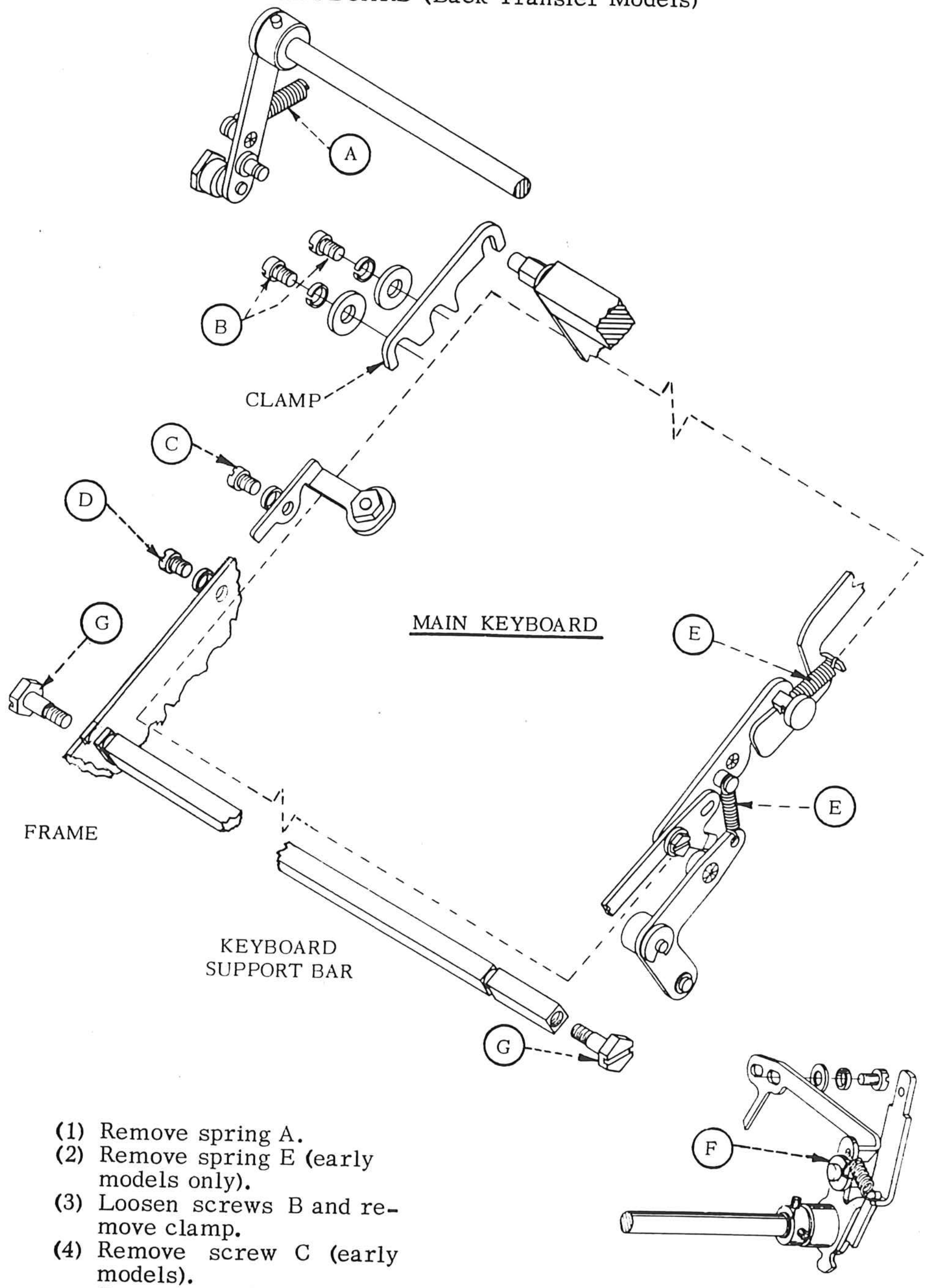
Removing a single Keystem:

(1) Remove the two guide rods that pass through keys in the row.
(2) Remove keytop and barrel spring.
(3) Drop key out the bottom of keyboard.

NOTE: On machines with the leaf springs located on the rear key section support, care must be taken when removing or installing the keyboard as the springs are easily ruptured.

DISASSEMBLY & ASSEMBLY

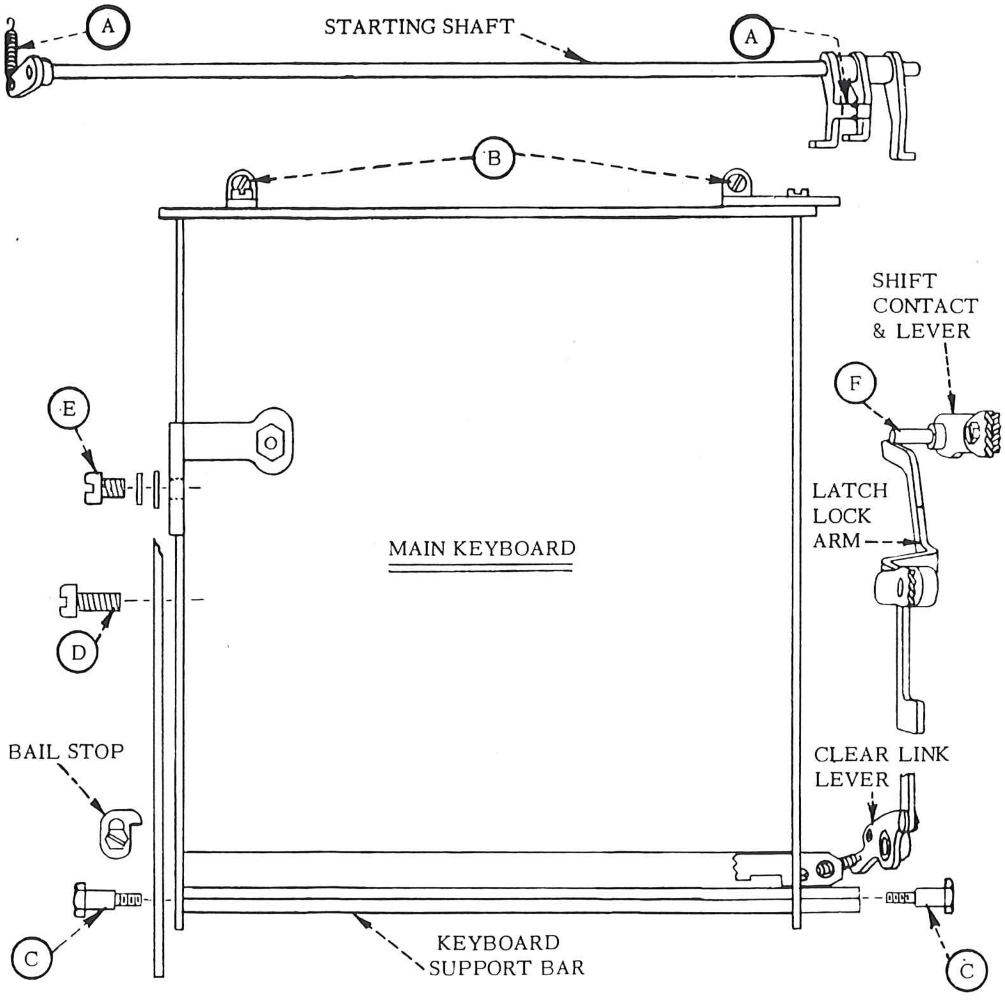
REMOVAL OF MAIN KEYBOARD (Back Transfer Models)



(1) Remove spring A.
(2) Remove spring E (early models only).
(3) Loosen screws B and remove clamp.
(4) Remove screw C (early models).
(later models) Turn screw D OUT to clear the keyboard.
(5) Remove clip F (later models).
(6) Remove screws G.
(7) Lift out keyboard.

NOTE: Always rest keyboard on key tops. Care must be taken not to damage the leaf springs on the rear of the keyboard. To reinstall keyboard, reverse Step 1 through 7.

REMOVAL OF MAIN KEYBOARD (Square Root Models)

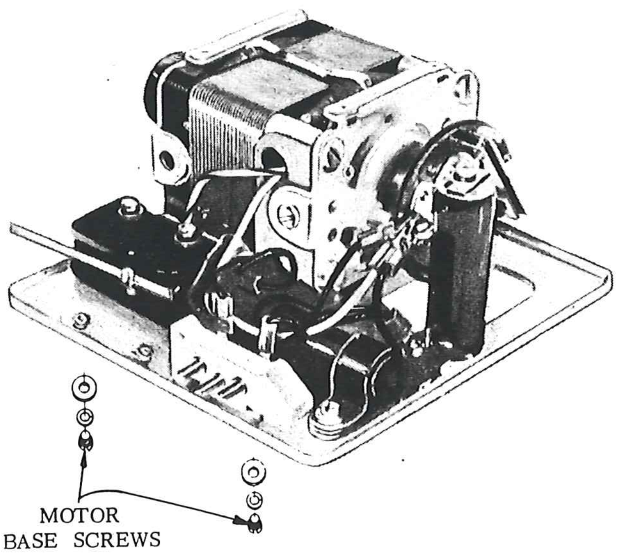


(1) Unhook springs A.
(2) Remove screws B (early models only).
(3) Unhook keyboard lockbar spring at clear link lever (early models only).
(4) Remove bail stop.
(5) Remove screws C.
(6) Remove Screws - early models screw D.
- later models screw E
(7) Lift out rear of keyboard and remove toward rear left. (Be careful not to disturb the programming unit.)

NOTE: Always rest keyboard on keytops.

TO INSTALL: Position the right front of the keyboard first, then lower the rear into position - make sure not to disturb the programming unit. Have the latch lock arm to the right of the selection levers, and in front of F of shift contact levers.

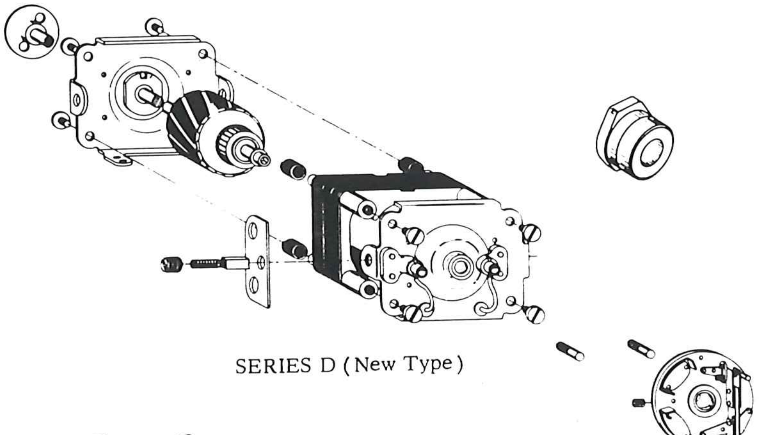
REMOVAL OF MOTOR



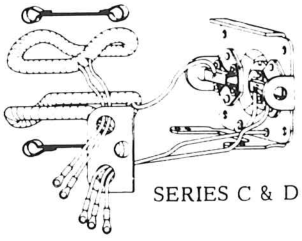
COMPLETE MOTOR

1. (1) Shift carriage to the left - or remove.
2. (2) Set machine on right side.
3. (3) Remove four motor base screws.
4. (4) Remove motor assembly.
5. (5) Remove fish paper insulation between motor and base.
6. (6) Remove two fish paper insulators and the leather coupling, between motor and slip clutch.

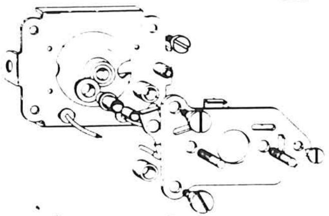
To reinstall motor, reverse Step 1 through Step 6. While the machine is still on it's right side, run motor (only) moving it around to find point of least noise and vibration and tighten the four motor base screws.



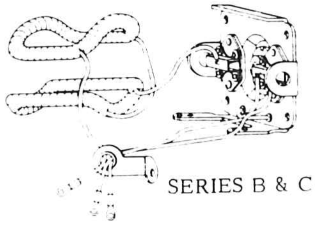
SERIES D (New Type)



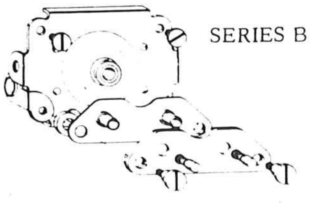
SERIES C & D



SERIES C, D & CS
(Old Type)

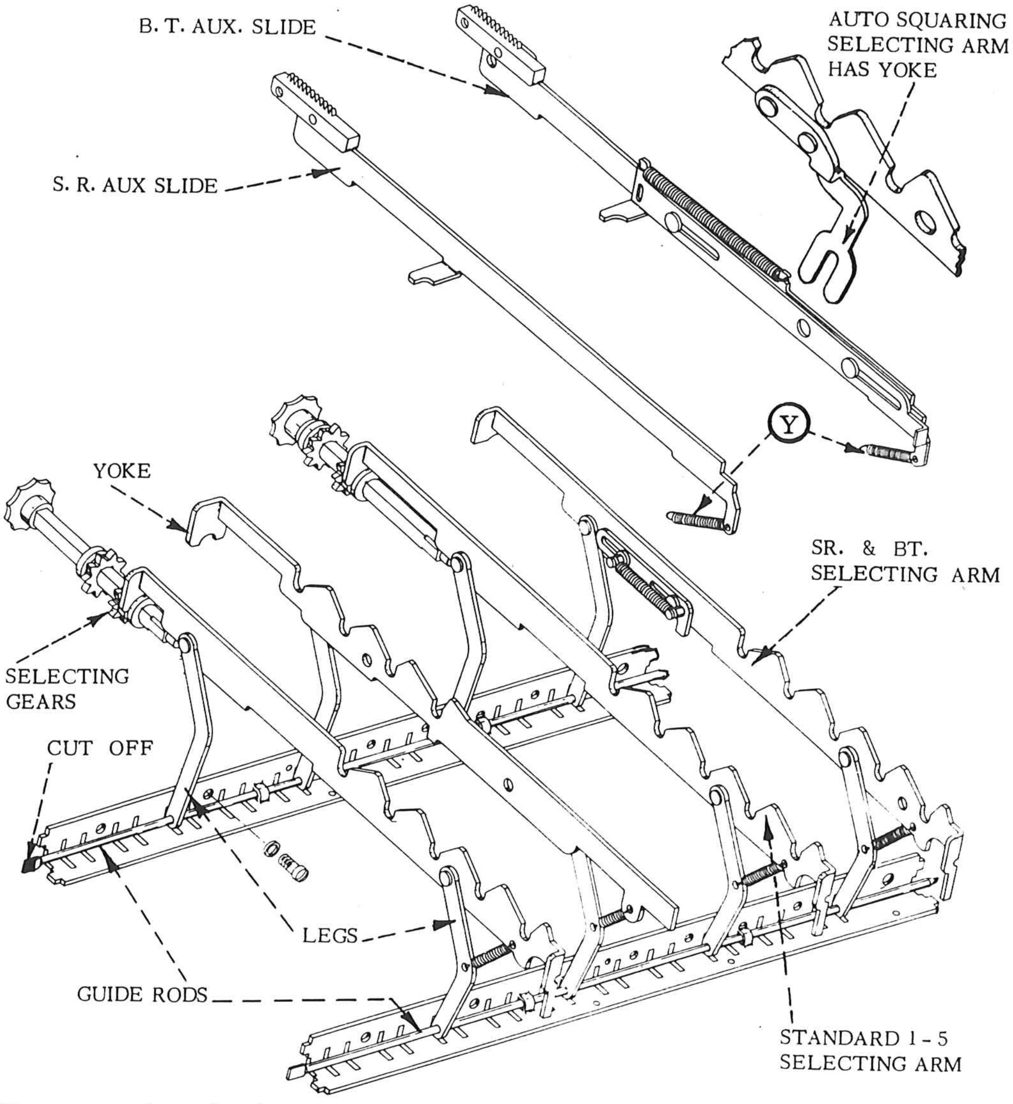


SERIES B & CS



SERIES B

REMOVAL OF SELECTING ARMS



To remove the selecting arms on a machine with a multiplier unit, it is faster and easier to ruin the guide rods and replace with new ones. To remove, pull guide rod to left, bend down, pull left and bend down until removed.

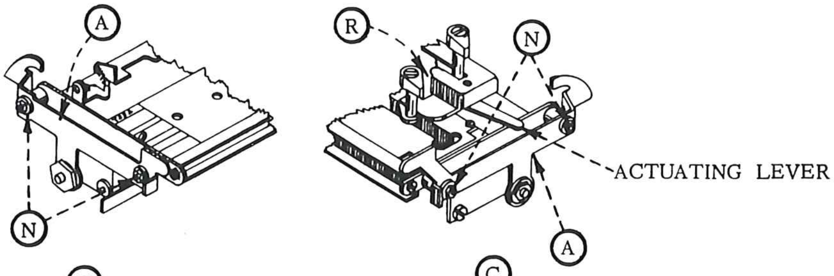
After guide rods are removed, the selecting arm can be lifted out.

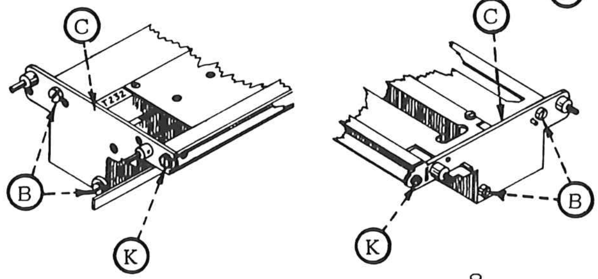
TO REINSTALL: Set selecting arms in, placing the yokes on the selecting arms in the grooves on the selecting gears. The selecting arms are installed starting from the right long rear, short rear, long front and short front, and etc.

Insert new guide rods from right side.

NOTE: On machine with power set gate it will be necessary to cut the flat end of the guide rod off (shown in black). To remove auxiliary slides, unhook springs Y, spring auxiliary slides to the right and selecting arms to the left. Lift out auxiliary slide.

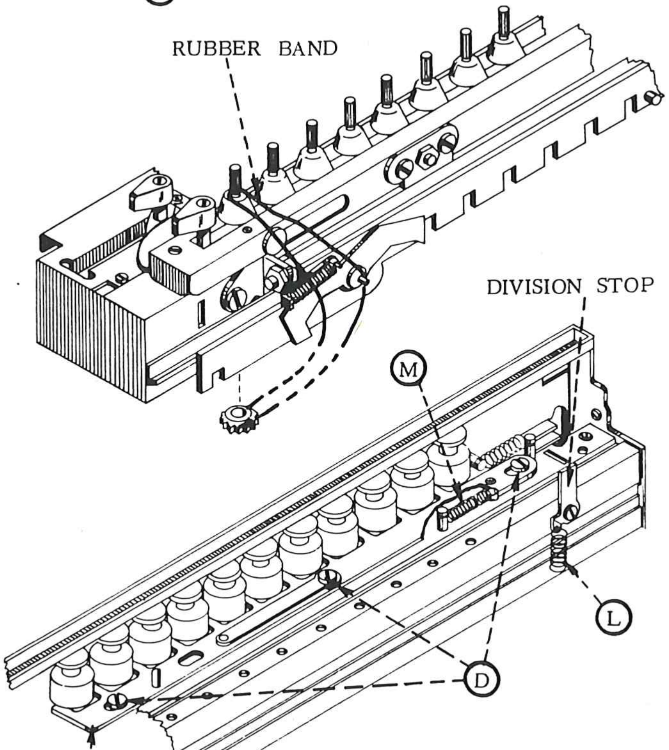
SEPARATING CARRIAGE FRAMES TO CHANGE ACCUMULATOR DIAL OR CLEAR RACK

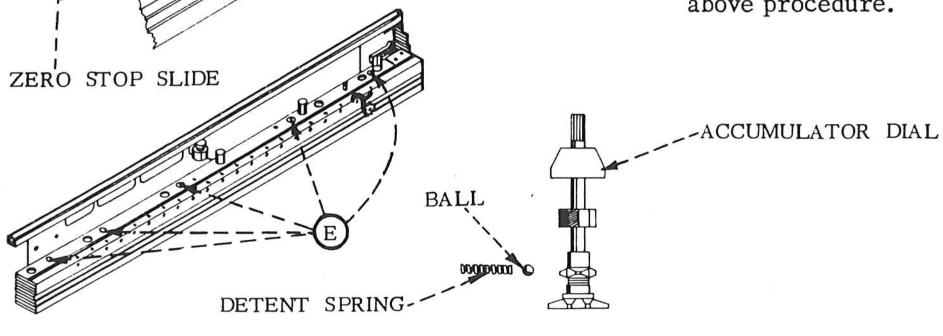




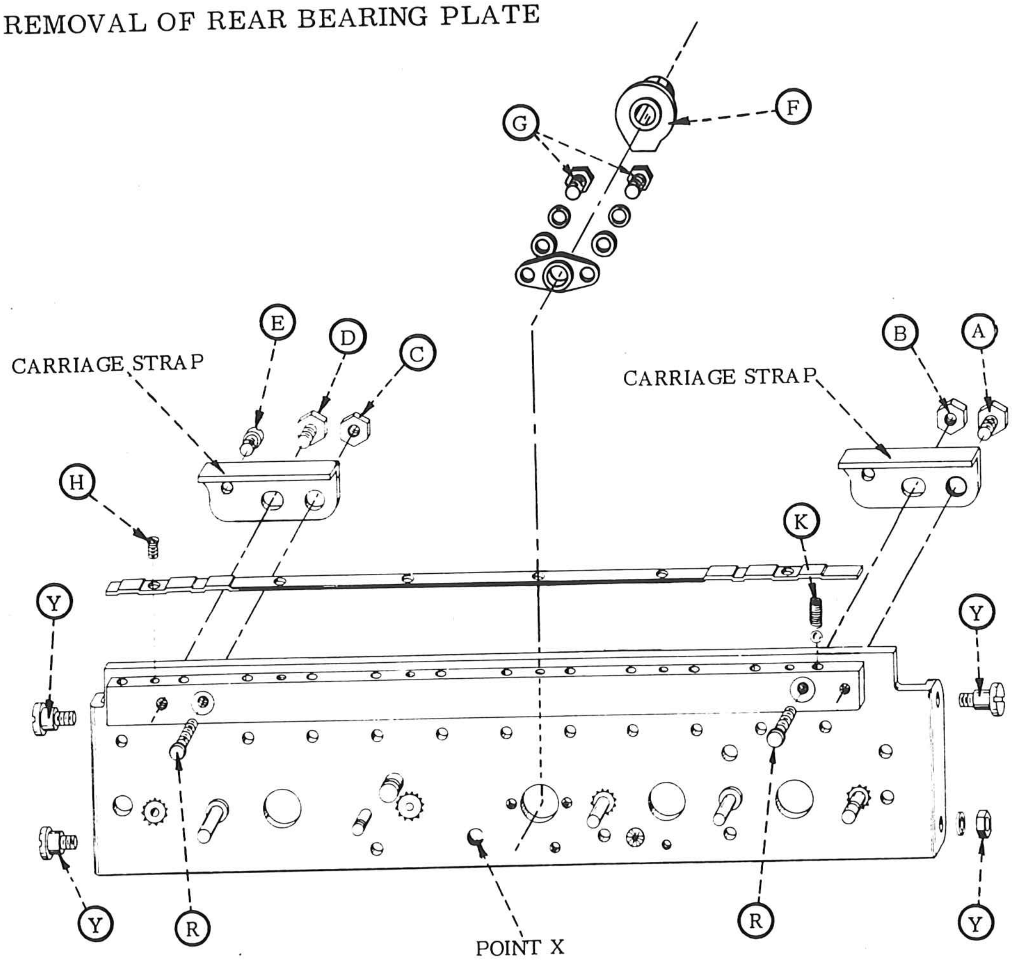
Procedure for separating the carriage frames for removing accumulator dials or accumulator clear racks.

(1) Remove nuts (N) and washers from end plate studs and remove carriage cover supports (A).
(2) Remove screws (B) and (K) from right and left end of carriage and remove end plates (C).
(3) Remove screw (R) from the actuating lever and remove the lever.
(4) Unhook division stop spring (L) from stud.
(5) Place rubber bands around the back of the carriage between the twirler knobs and the dial gears.
(6) Remove screws (D) and spring (M) from the counter zero stop slide and remove the slide.
(7) Carefully remove screws (E) from the carriage frames and separate the front half from the rear half. The dials will remain on the rear half of the carriage frame until the rubber bands are removed. When removing the dials, catch the detent balls and springs. To reassemble reverse the above procedure.





REMOVAL OF REAR BEARING PLATE

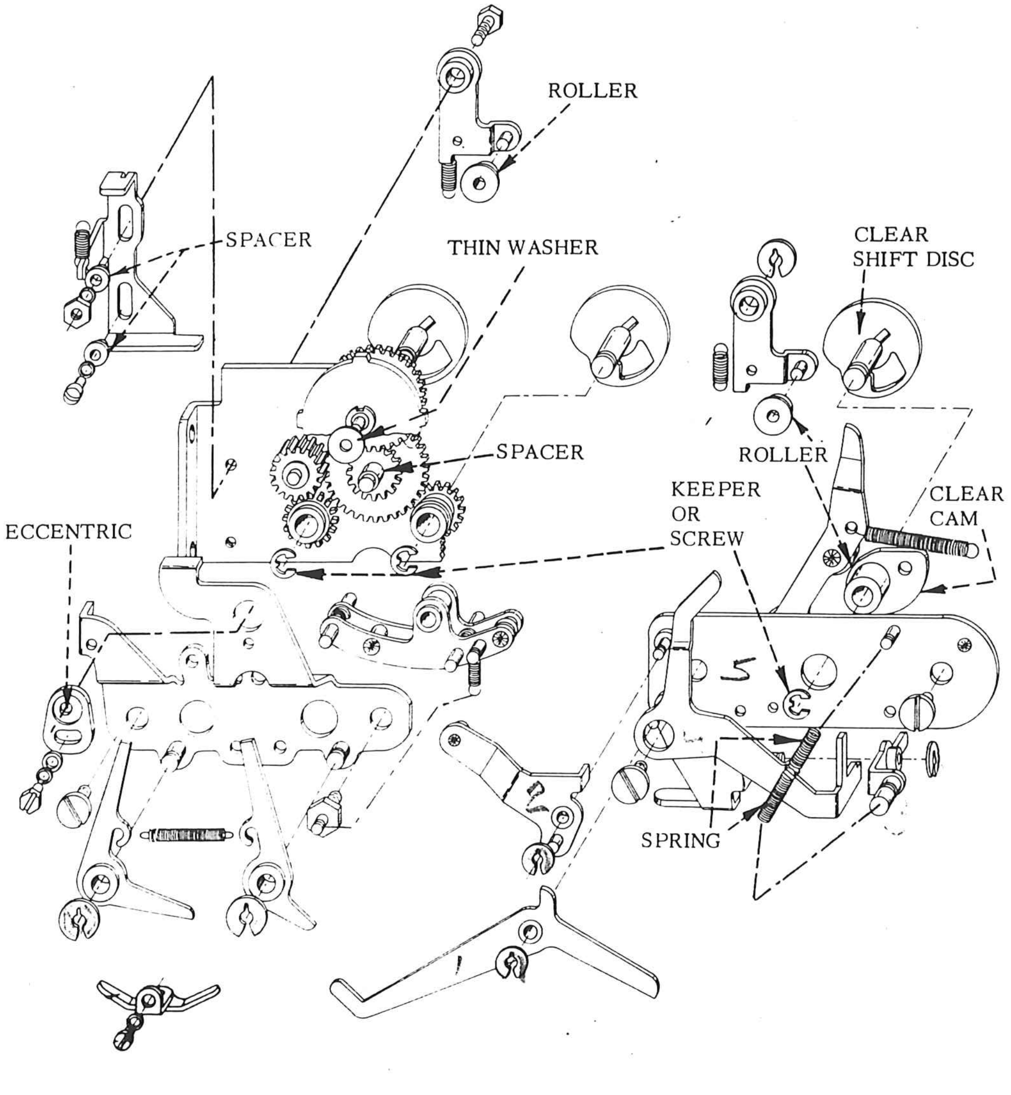


(1) Remove carriage.
(2) Remove screws A-D-E.
(3) Remove nuts B-C.
(4) Remove carriage straps.
(5) Remove screws H from detent ball and spring retainer strip.
(6) Lift out springs K.
(7) Remove cam F and screws G and remove bearing.
(8) Remove screw or clip from Point X.
(9) Remove screws and nuts Y.
(10) Place grease rag under bearing plate to catch detent balls - lift off rear bearing plate.

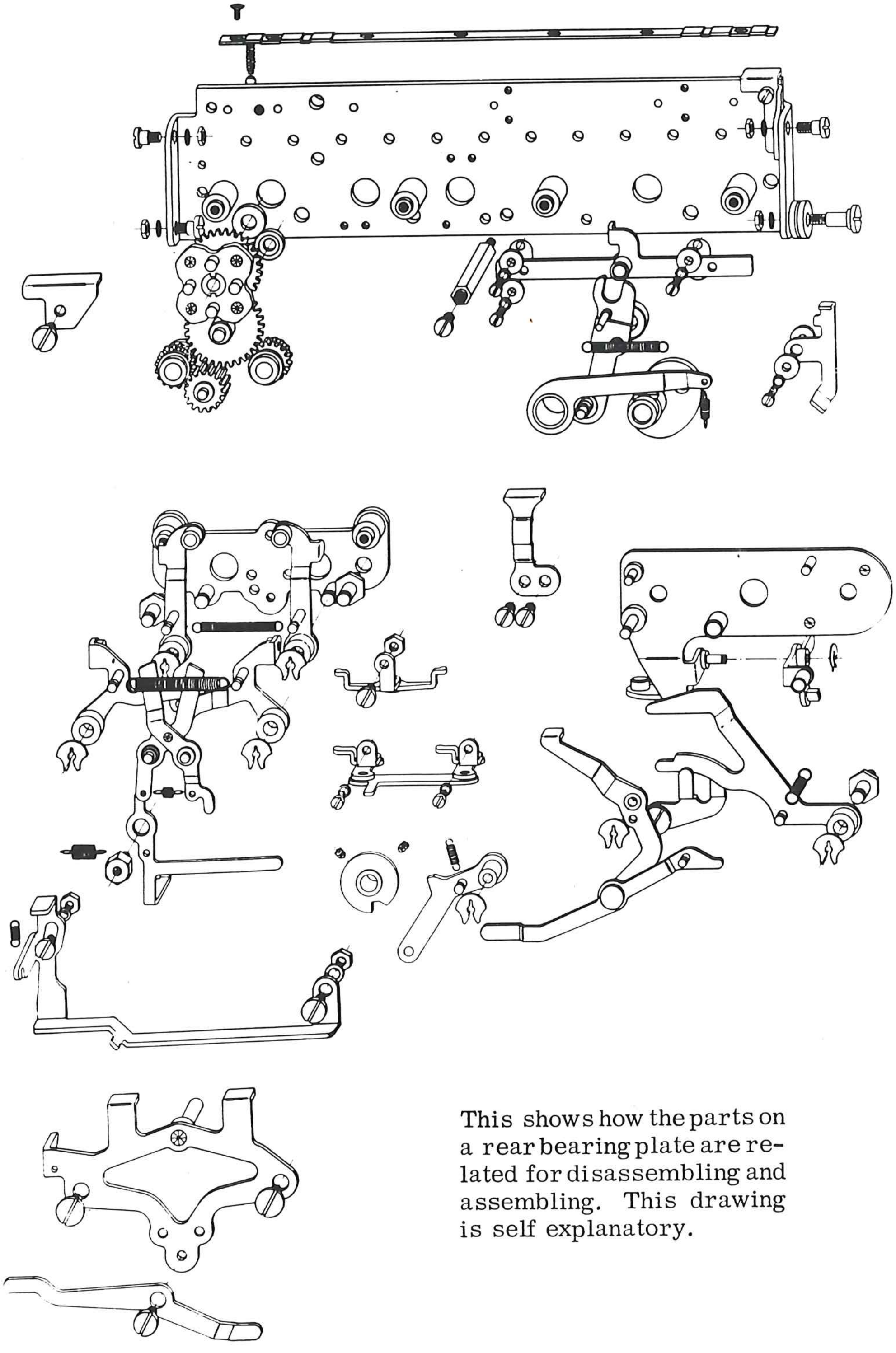
DISASSEMBLY & ASSEMBLY

DISASSEMBLY OF REAR BEARING PLATE

This shows how the parts on a rear bearing plate are related for disassembling and assembling. This drawing is self explanatory.



DISASSEMBLY OF REAR BEARING PLATE (Four Point Shift)

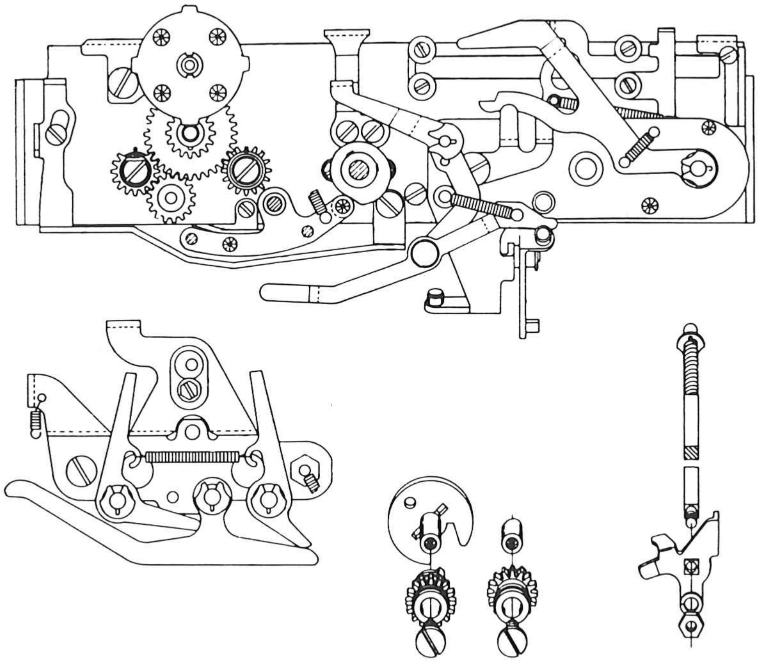


This shows how the parts on a rear bearing plate are related for disassembling and assembling. This drawing is self explanatory.

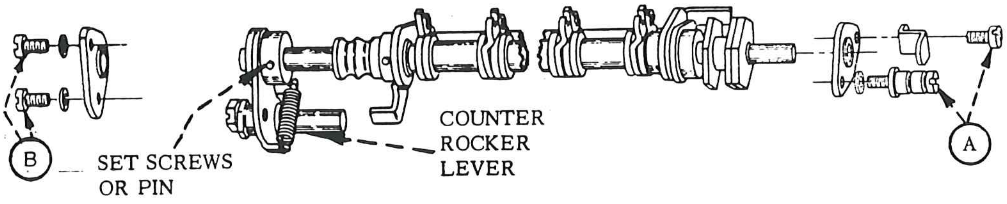
DISASSEMBLY & ASSEMBLY

DISASSEMBLY OF REAR BEARING PLATE (Early Style Smooth Shift)

This shows how the parts on a rear bearing plate are related for disassembling and assembling. This drawing is self explanatory.

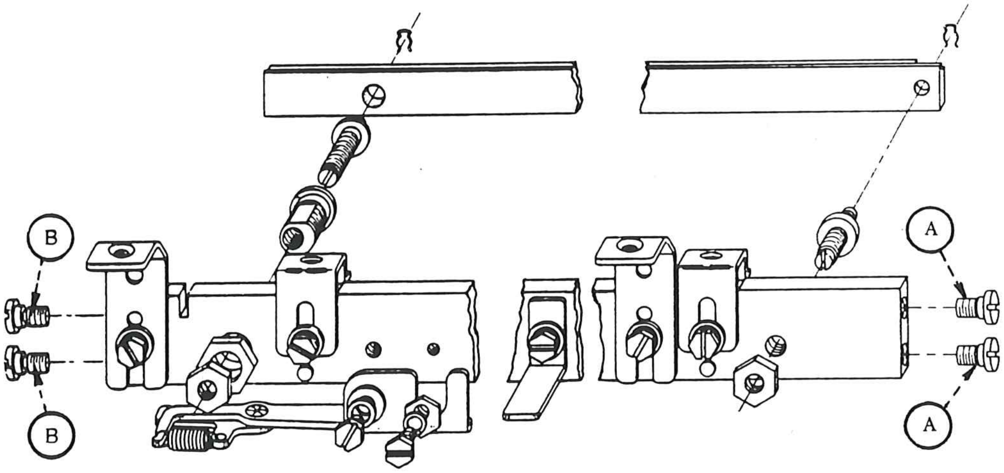


COUNTER CARRIER REMOVAL



(1) Loosen set screws (or if pinned, remove the pin) on the counter rocker lever.
(2) Remove counter rocker lever.
(3) Remove Screws A from the right counter bearing.
(4) Remove Screws B from the left counter bearing.
(5) Remove the right counter bearing.
(6) Move the add-subtract gate into subtract position. This lowers the counter oscillating arm to permit easier removal of the counter.
(7) Lift the right end of the counter first, then remove the counter. The left bearing will remain on the shaft.

FRONT CARRIAGE SUPPORT BAR REMOVED

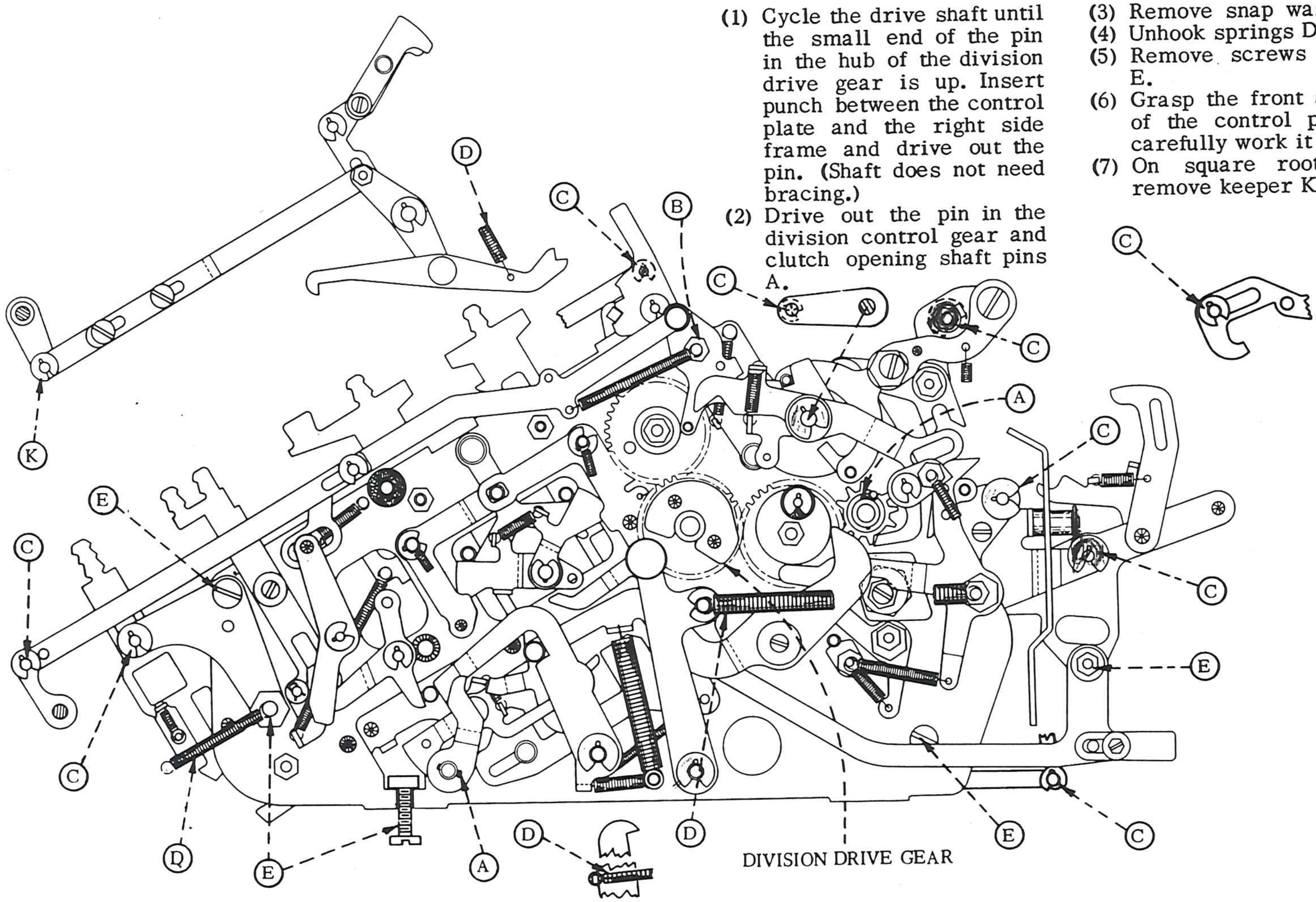


(1) Remove Screws A.
(2) Remove Screws B.

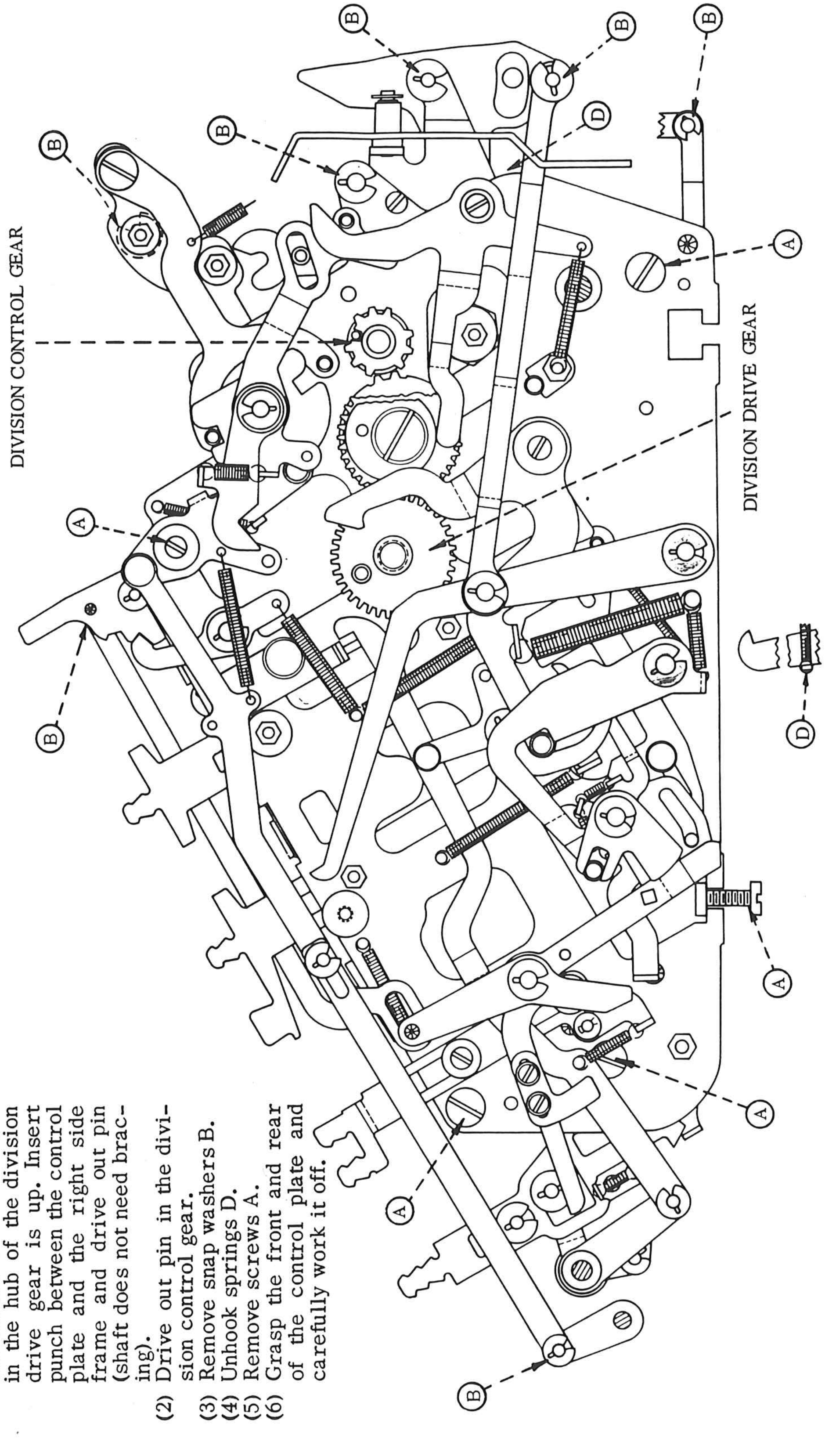
This drawing shows the support bar assembly for Standard Models (does not include BT or SR Models, however, the removal is the same.

REMOVAL OF CONTROL PLATE (Current Models)

(1) Cycle the drive shaft until the small end of the pin in the hub of the division drive gear is up. Insert punch between the control plate and the right side frame and drive out the pin. (Shaft does not need bracing.)
(2) Drive out the pin in the division control gear and clutch opening shaft pins A.
(3) Remove snap washers C.
(4) Unhook springs D.
(5) Remove screws and nuts E.
(6) Grasp the front and rear of the control plate and carefully work it off.
(7) On square root models remove keeper K.

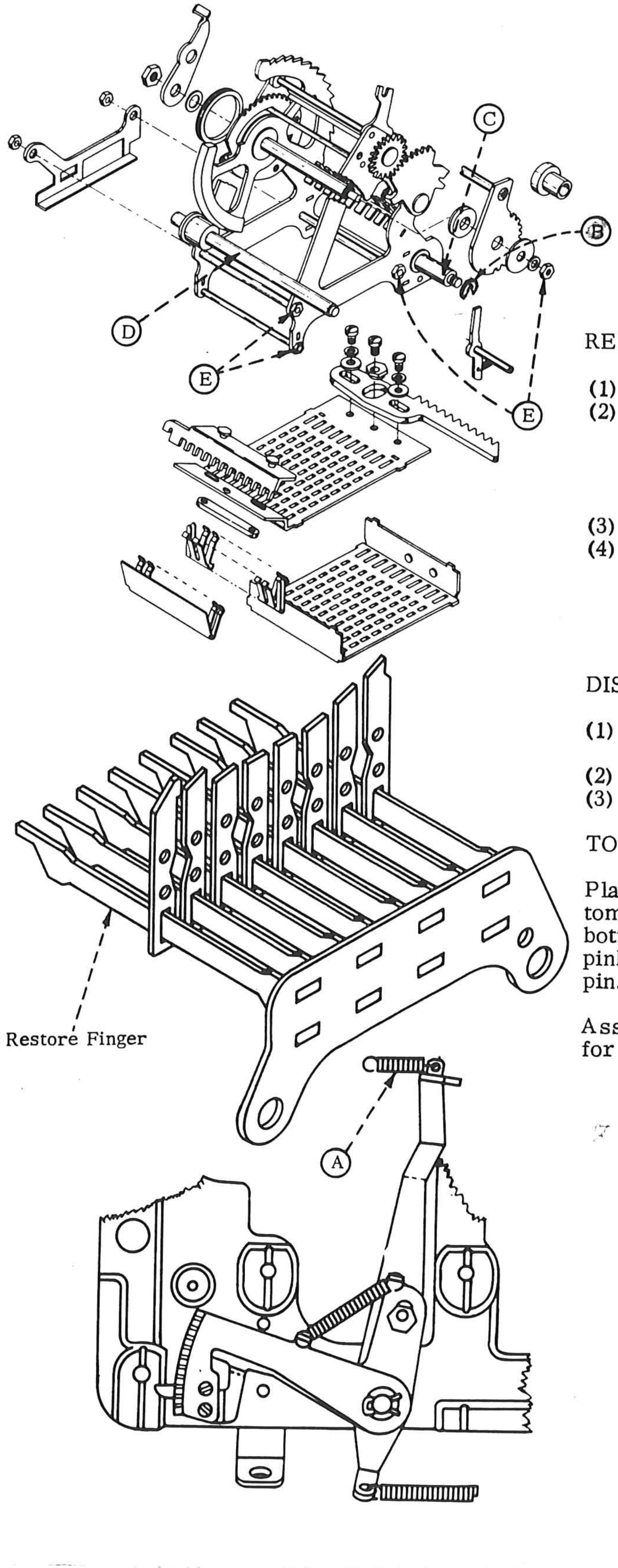


REMOVAL OF CONTROL PLATE (Early Models)



(1) Cycle the drive shaft until the small end of the pin in the hub of the division drive gear is up. Insert punch between the control plate and the right side frame and drive out pin (shaft does not need bracing).
(2) Drive out pin in the division control gear.
(3) Remove snap washers B.
(4) Unhook springs D.
(5) Remove screws A.
(6) Grasp the front and rear of the control plate and carefully work it off.

REMOVAL & DISASSEMBLY OF MULT UNIT



REMOVE MULTIPLIER UNIT

(1) Unhook spring A.
(2) Remove snap washer B. Remove shaft C. (On late models the shaft is held by a retainer plate at the left end.
(3) Remove shaft D.
(4) Move the unit to the extreme left. Work the unit out. Care must be taken not to bend the restore fingers.

DISASSEMBLE THE UNIT

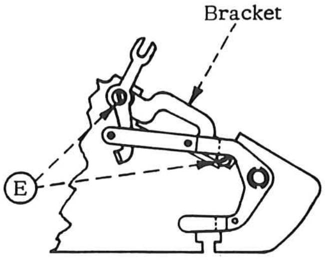
(1) Remove nuts E from right side of unit.
(2) Remove right side frame.
(3) Remove pinboard.

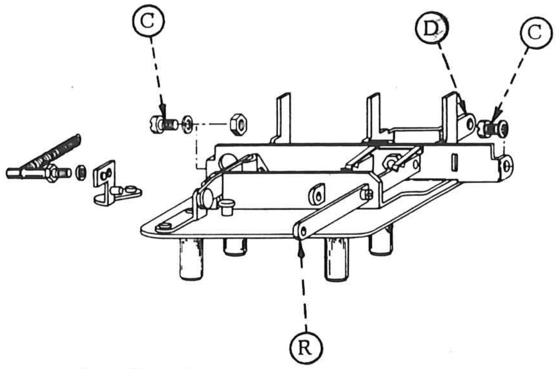
TO REPLACE A PIN

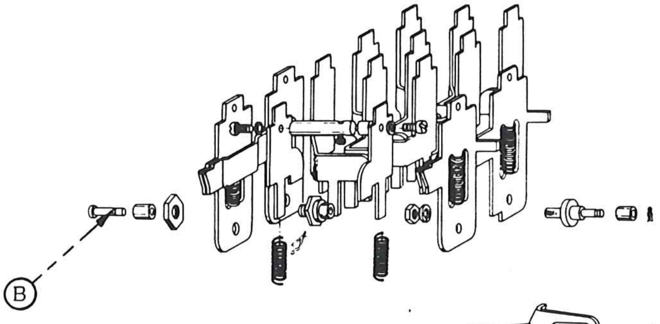
Place an extra pinboard bottom plate upside down over the bottom of the pins. Remove pinboard top plate. Replace pin.

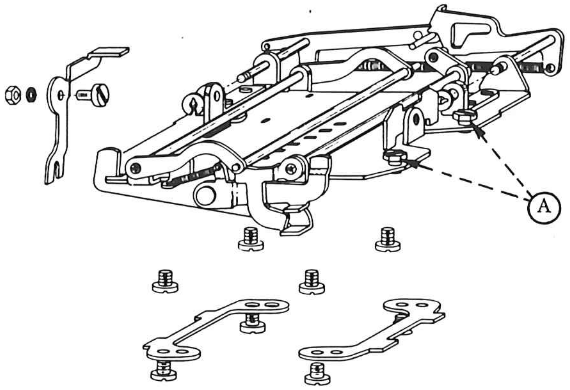
Assemble unit. Check sectors for free rotation.

REMOVAL & DISASSEMBLY OF MULT KEYBOARD





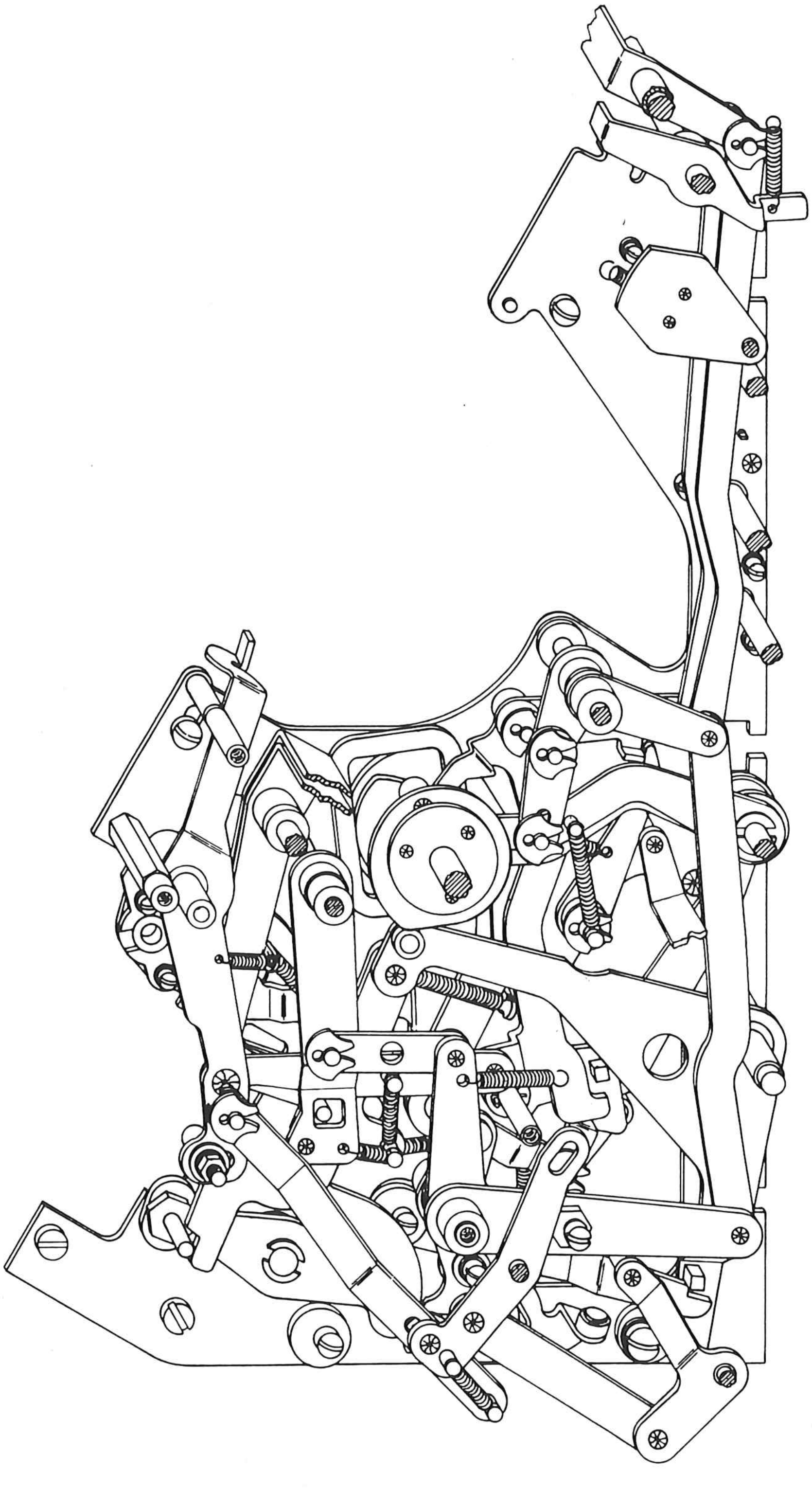




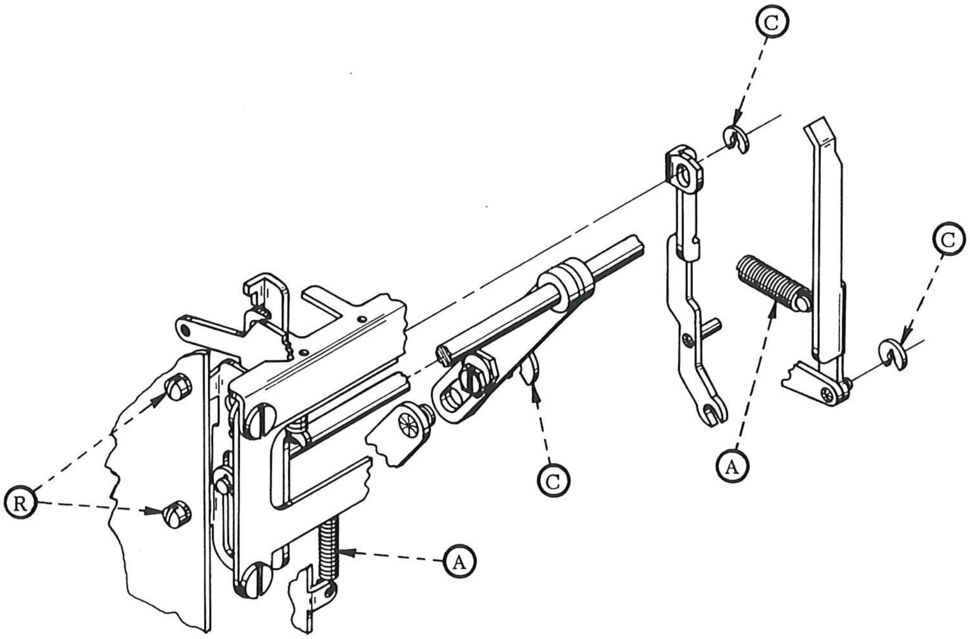
(1) Remove screws A.
(2) Pull out pins B on accum. mult. and neg. mult. key.
(3) Remove screws C.
(4) Remove snap washer D.
(5) Loosen screws E and remove bracket.
(6) Remove screw R.
8 (7) Remove multiplier keyboard.

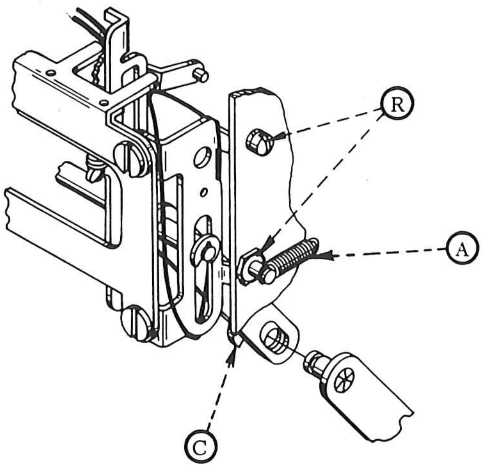
7. move screws [illegible]
[illegible]

MULT SECTION PARTS RELATIONSHIP



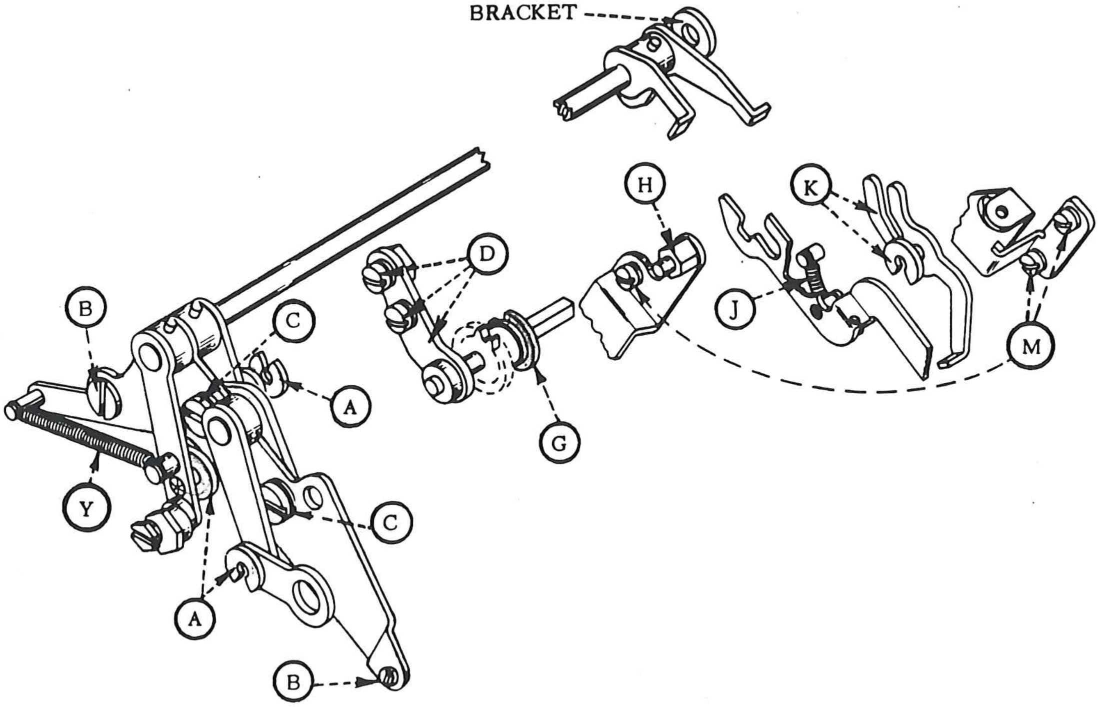
REMOVAL OF AUTOMATIC SQUARING UNIT





(1) Remove springs A.
(2) Remove keepers C.
(3) Remove screws R.
(4) Lift unit out.

REMOVAL OF BACK TRANSFER PROGRAM UNIT



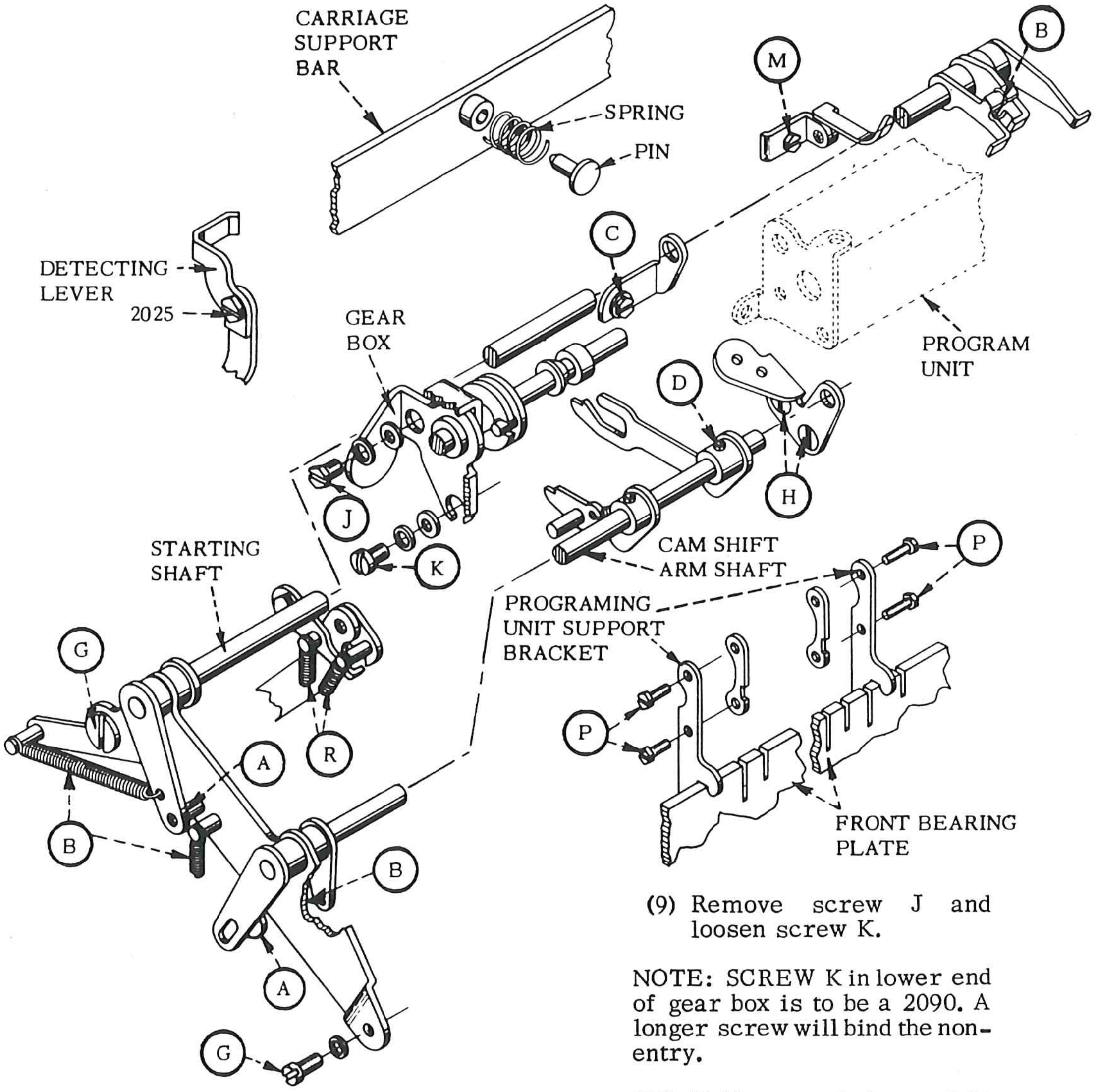
(1) Remove clip A and spring Y.
(2) Remove screws B.
(3) Remove screws C.
(4) Remove screws D and bearing bracket. When installing rear screw, be sure it is very tight.
(5) Remove clip G - move gear to right - reinstall clip.
(6) Remove screw H.

NOTE: When removing the hex screw stud H, throw it away and replace with a new one.

(7) Unhook rear of spring J.
(8) Remove keeper and arm K.
(9) Remove screws M.
(10) Lift out back transfer program unit and starting shaft together - take care not to distort unit.

NOTE: It is a good idea to tighten screws in unit before reinstalling. Check wire springs on selection holding pawls for being too long, short or hanging up. Check selection adjustments while unit is out of machine.

SQUARE ROOT PROGRAM UNIT



(1) Move keyboard lock key forward.
(2) Remove clips from point A.
(3) Unhook spring B.
(4) Loosen screw C.
(5) Loosen allen screw D and move entry link to the left.
(6) Remove screws G.
(7) Remove screws H.
(8) Remove starting shaft and cam shift arm shaft. Be careful not to lose the tab clear pin and spring from the carriage support bar.

(9) Remove screw J and loosen screw K.

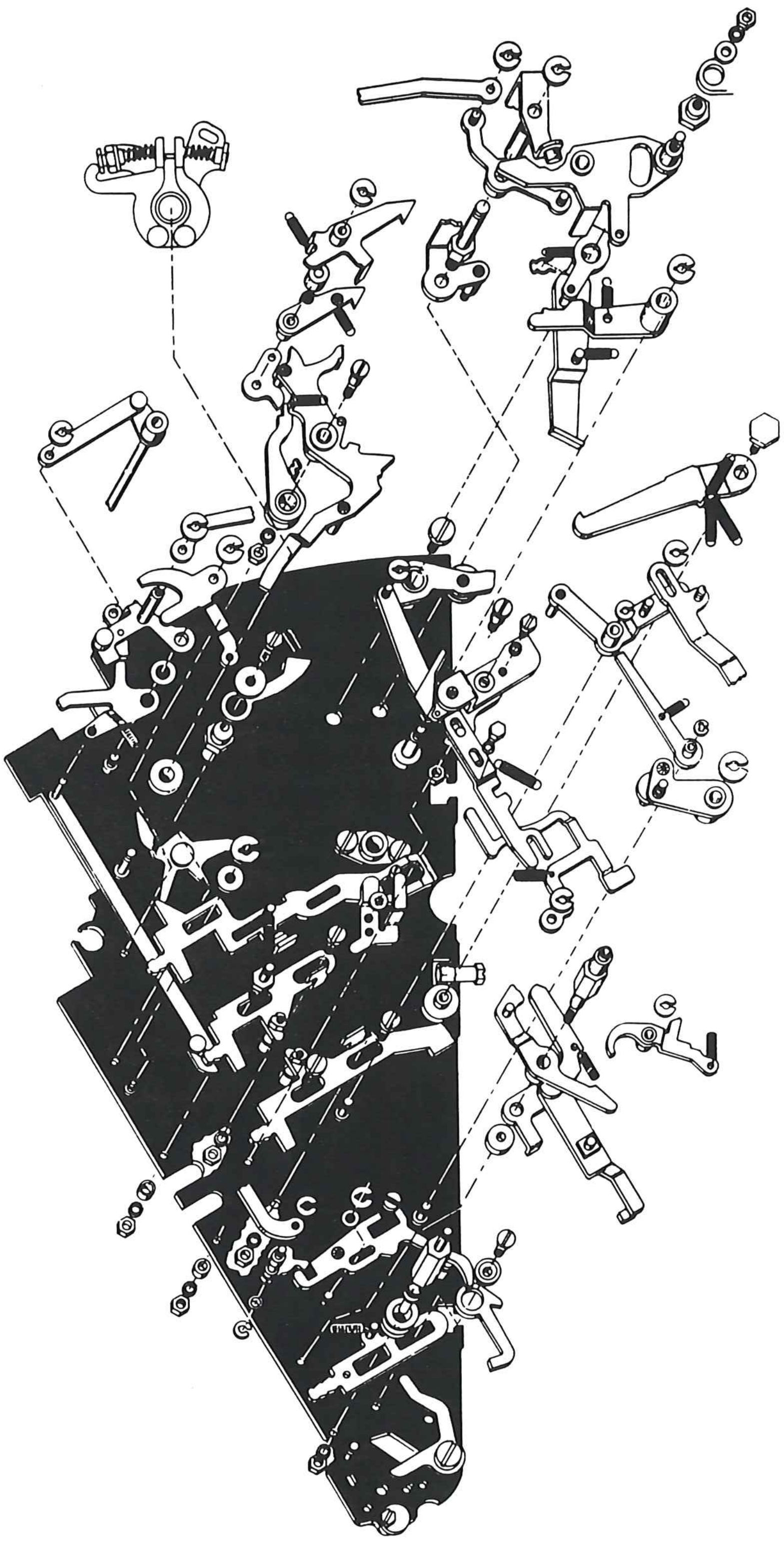
NOTE: SCREW K in lower end of gear box is to be a 2090. A longer screw will bind the non-entry.

(10) Hold cam shaft to right and shift out gear box.
(11) Loosen screw M and remove eighth (8th) position tab actuator.
(12) Remove screw P - use wrench SS-123 only.
(13) Unhook springs R.
(14) Lift out program unit. Do not distort unit support brackets.

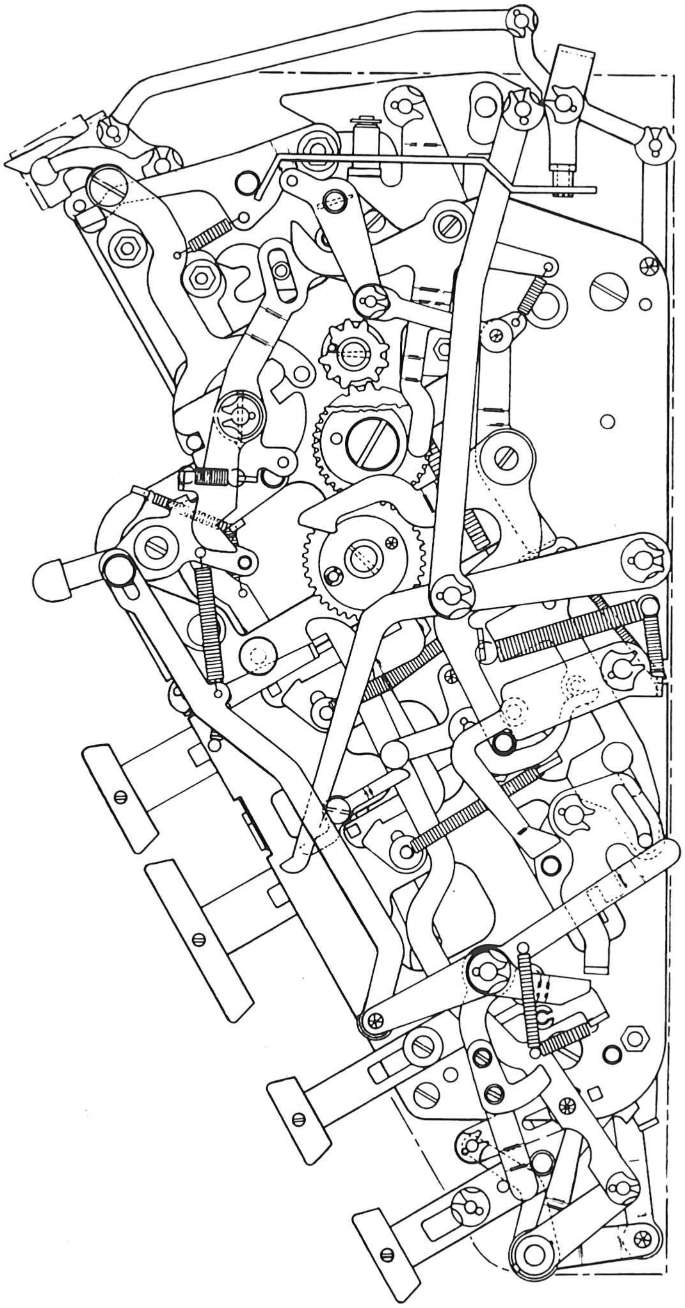
NOTE: Before reinstalling unit, be sure screws in unit are tight. To prevent damage to the slip clutch, a 2025 screw without a lock washer is to be used on the detecting lever.

DISASSEMBLY & ASSEMBLY

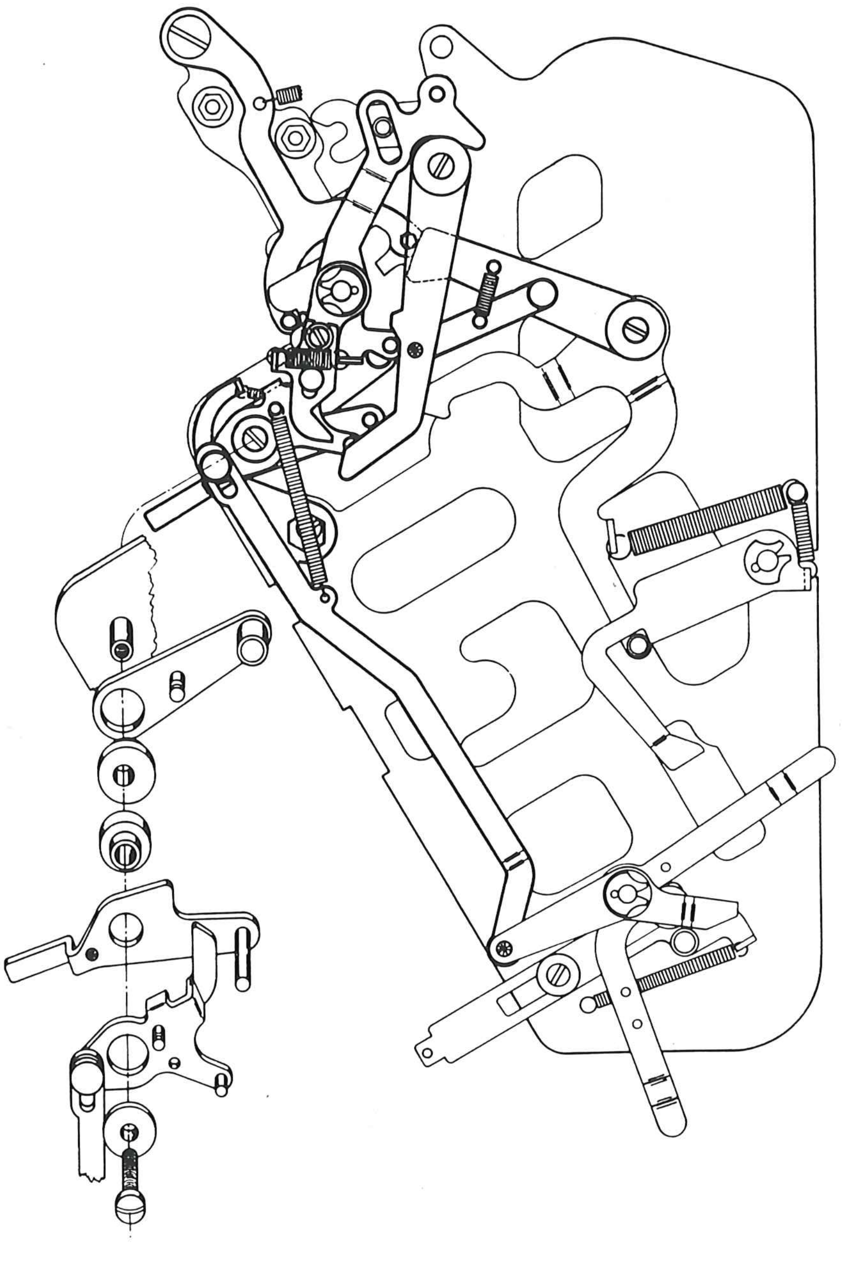
RIGHT SIDE FRAME PARTS ASSEMBLY



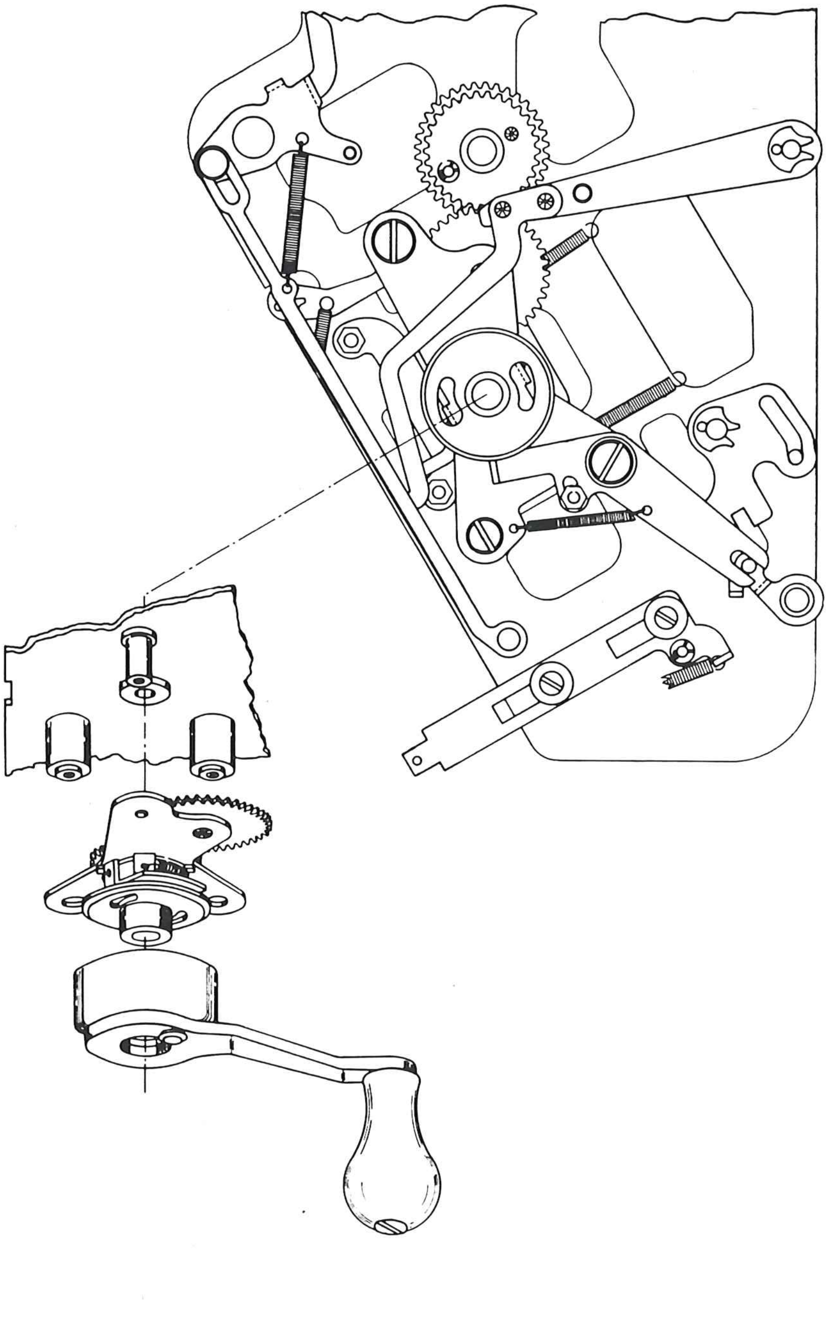
GREY LINE CONTROL PLATE



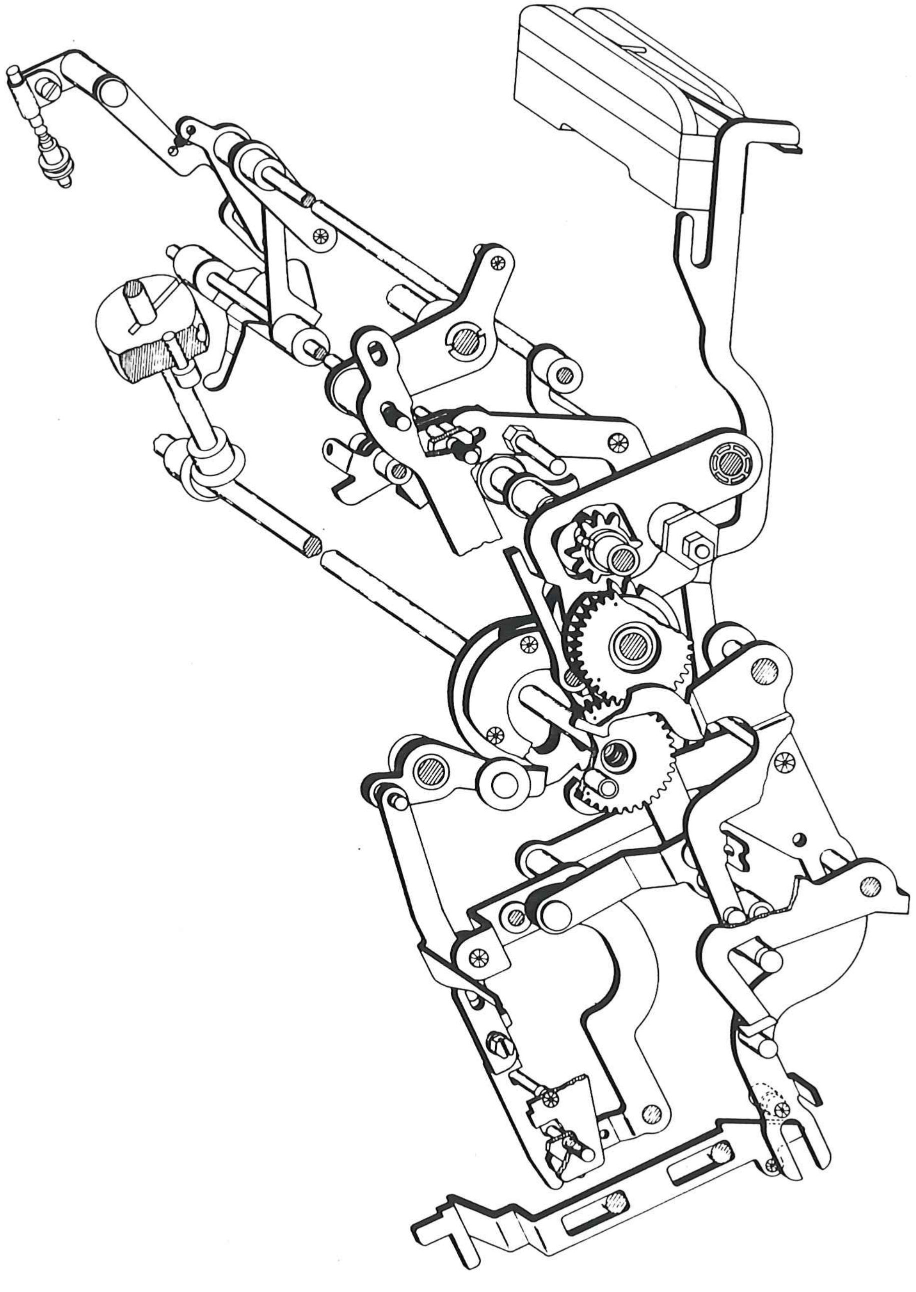
EARLY GRADIENT CONTROL PLATE



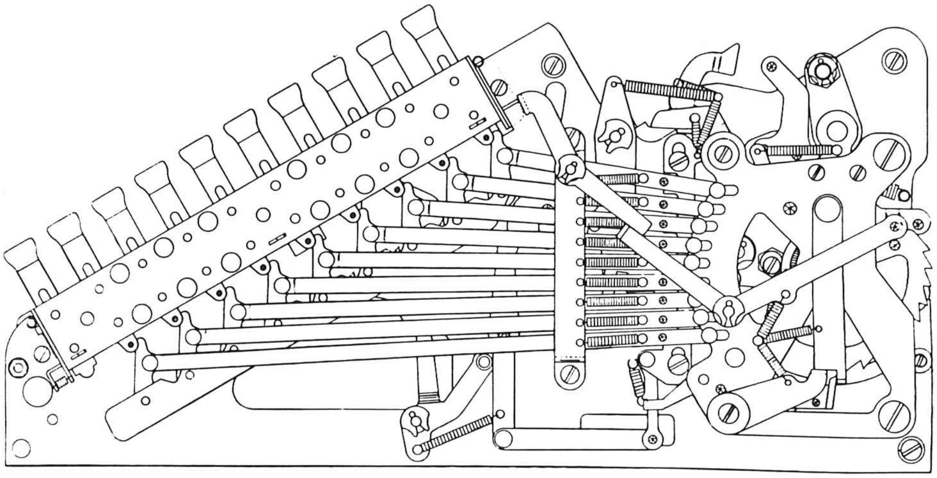
CONVERTABLE HAND CRANK

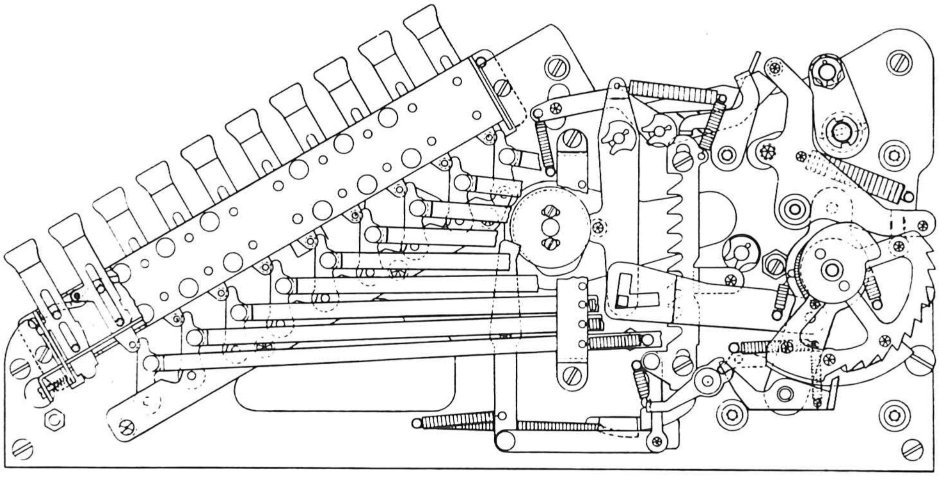


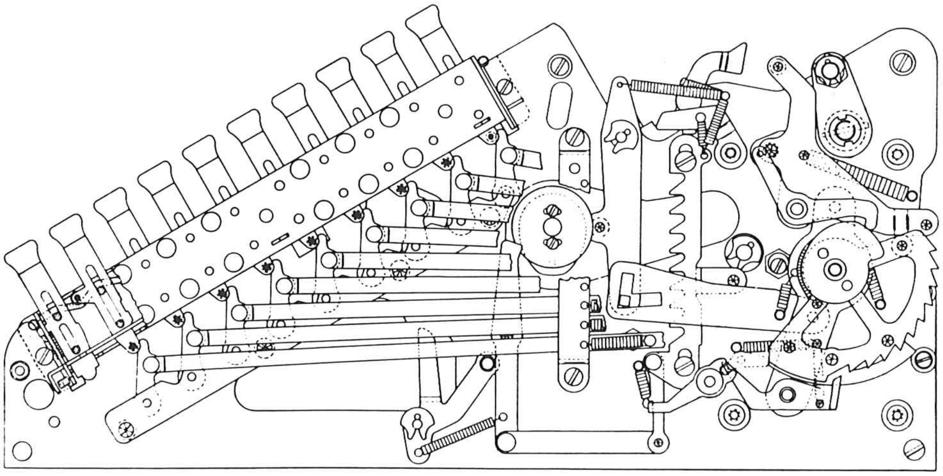
EARLY DIVISION MECHANISM



"F" MULTIPLIER MECHANISM







TROUBLE SHOOTING

SERVICE PROBLEMS AND WHAT TO CHECK

Note: Numbers listed after certain items in this Check list refer to adjustments related to that item.

ERRORS IN ADDITION AND SUBTRACTION

1. CONDITION OF PARTS:

   a. Worn or damaged Transfer Lever
   b. Worn Transfer Cam on Accumulator Dial
   c. Broken, worn or damaged Transfer Gear
   d. Worn, loose or damaged Accumulator Dial Gear
   e. Transfer Lever missing Transfer Cam
   f. Worn transfer Lever bearings in Carriage Frame
   g. Stuck Detent Ball in Accumulator Dial, Add-Subtract Gear Shaft or Transfer Pin.
   h. Spring missing or broken in Detent
   i. Worn or damaged Add-Subtract Gear
   j. Spring Transfer failing
   k. Loose Pins in Add-Subtract Gate Shaft
   l. Worn Hub 6081 on Gate Control Lever
   m. Worn or damaged Geneva or Geneva Disc on Actuator
   n. Worn or damaged Selecting Gear
   o. Worn or damaged Cycle Lock Pin
   p. Backlash in Actuators
   q. Keyboard Clear Mechanism, Section 4, Adj. 2, Fig. 16

2. CARRIAGE ADJUSTMENTS:

   a. Carriage too loose or too tight, Section 5, Adj. 1
   b. Adjustment of Transfer Levers to Transfer Gears, Section 5, Adj. 1
   c. Carriage Shift Rack loose or out of adjustment, Section 5, Adj. 8, Fig. 1
   d. Transfer Lever alignment, Section 5, Adj. 1

3. ADD-SUBTRACT GATE CONTROL ADJUSTMENTS:

   a. Add-Subtract Gate Centralizer, Section 6, Adj. 1, Fig. 1
   b. Plus-Minus Key to Gate, Section 6, Adj. 2, Fig. 1 & 3
   c. Add-Subtract Gate Stops, Section 6, Adj. 2, Fig. 5, Section 7. Adj. 1, Section 6. Adj. 2, Fig. 5
   d. Cycle Lock Pin, Section 5, Adj. 2, Section 6, Adj. 1, Fig. 3
   e. Extra Transfer, Section 5, Adj. 8, Fig. 2, Section 5, Adj. 4, Fig. 1 & 2
   f. Geneva setting, Section 1, Adj. 3
   g. Loose Screws or Studs

Note: ALWAYS check these points first when errors occur, regardless of the operation in which errors are noted.

TROUBLE SHOOTING

ERRORS IN COUNTER

1. CONDITION OF PARTS:
    - a. Worn or bent Counter Primary Tooth
    - b. Bent Counter Secondary Tooth
    - c. Blocking Lever on #1 Counter Tooth out of line
    - d. Counter Blocking Slide worn or out of adjustment
    - e. Secondary Lug cutting into Primary Tooth
    - f. Loose Screws or Studs
    - g. Worn or damaged Oscillator Arm, Section 7, Adj. 2, Fig. 1
    - h. Worn or damaged Oscillator Cam, Section 7, Adj. 2, Fig. 1
2. ADJUSTMENTS
    - a. Adjustment to right or left for full throw, Section 7, Adj. 1, Fig. 3
    - b. Adjustment of Rocker Lever for proper clearances, Section 7, Adj. 1
    - c. Spiral Alignment of Secondary Teeth; Section 7, Adj. 1, Fig. 6
    - d. Counter Blocking Slide adjustment, Section 7, Adj. 1
    - e. Multiplier Non-entry adjustment, Section 7, Adj. 1, Fig. 10
3. FAILS TO COUNT:
    - a. Dividend Tabulator Counter Blocking Slide binding, Section 8, Adj. 7
    - b. Adjustment off on right and left for full throw, Section 7, Adj. 1, Fig. 3
    - c. #1 Counter Primary Tooth bent, Section 7, Adj. 1, Fig. 6
    - d. Multiplier Non-Entry engaged or binding, Section 7, Adj. 1, Fig. 10
4. FAILS TO TRANSFER:
    - a. Secondary Counter Tooth bent, Section 7, Adj. 1, Fig. 6
    - b. Secondary Counter Tooth hitting bottom of notch in Cam, Section 7, Adj. 1, Fig. 6
    - c. Spring off or parts binding
    - d. Primary Counter Tooth bent, Section 7, Adj. 1, Fig. 6
5. SECONDARY PICK-UP: (False Transfer):
    - a. Spiral alignment of Secondary Teeth out of adjustment, Section 7, Adj. 1, Fig. 6
    - b. No thrust Spring in Counter Dial, Counter Dial dropping down in the way of Secondary Tooth
    - c. Worn or loose Counter Blockout Cam
6. COUNTER PICKS UP WHILE CARRIAGE IS SHIFTING:
    - a. Counter adjusted too far forward, Section 7, Adj. 1
    - b. Counter Blocking Slide worn or out of adjustment, Section 7, Adj. 1
    - c. Blocking Lever on #1 Counter Tooth bent, Section 7, Adj. 1

TROUBLE SHOOTING

DIVISION ALIGNER

1. CONDITION OF PARTS:

   a. Inside Division Latch not holding, check spring
   b. Worn or damaged Latches on Shift Actuator, Section 10, Adj. 4
   c. Sensing Lever or Cam on Throwout Shaft worn, Section 10, Adj. 3, Fig. 1, Section 1, Adj. 7 Fig. 2
   d. Sensing Fingers worn or sticking, Section 5, Adj. 1, Section 10, Adj. 5

2. ADJUSTMENTS:

   a. Shift Actuator adjustment and alignment to Shift Controllers, Section 10, Adj. 4
   b. Latches for restoring in Home Position, Section 10, Adj. 4
   c. Latch Bails, Section 10, Adj. 4
   d. Sensing Lever, Section 5, Adj. 1, Section 10, Adj. 5
   e. Sensing Fingers, Section 5, Adj. 1, Section 10, Adj. 5
   f. Last-order delatching levers, Section 10, Adj. 5
   g. Division Throwout Actuator Slide, Section 10, Adj. 4

DIVISION

1. CONDITION OF PARTS:

   a. FIRST check conditions listed for errors in addition and subtraction - A MUST - See Page 1
   b. Worn Add-Subtract Gate Control Stud Adjustment, Section 10, Adj. 3
   c. Shift Centralizer worn or without lubrication, Section 10, Adj. 3
   d. Loose Taper Pins in Division Control Gear Assembly
   e. Worn Stop Pin in Control Plate, Adjustment, Section 10, Adj. 2, Fig. 2
   f. Broken Parts

2. ADJUSTMENTS:

   a. FIRST check Basic Adjustments for addition and subtraction, See Page 1
   b. Add-Subtract Gate Control Stud Adjustment, Section 10, Adj. 3
   c. Division Shift Centralizer, Section 10, Adj. 3
   d. Add-Subtract Gate Bumper on Rear Bearing Plate, Section 6, Adj. 2, Fig. 5
   e. Clutch Latch, Section 4, Adj. 1, Fig. 1
   f. Control Arm Stop, Section 10, Adj. 3, Fig. 1
   g. Connector Arm on Long Transfer Pin, Section 10, Adj. 2, Fig. 1
   h. Throw of Shift Throwout Actuator for Division Control Gear, Section 10, Adj. 4
   i. Timing of Throwout Cam on #6 Actuator, Section 10, Adj. 2, Fig. 3 & 4
   j. Clearance of Throwout Actuator to Roller on #6 Actuator, Section 10, Adj. 2, Fig. 3 & 4
   k. Adjustments of Division Aligner, Section 10, Adj. 4, to Section 5, Adj. 1, Section 10. Adj. 5 inclusive

TROUBLE SHOOTING

Note: A good plan of attack on a Division Problem is to break it down into its various operations. Is the trouble occurring in:

a. Subtract Cycle?
b. Add Cycle?
c. Shift Cycle?
d. Aligner in first Carriage Position?
e. Aligner, Subtract Cycle?
f. Aligner, Add Cycle?
g. Aligner, Shift Cycle?
h. Aligner, going past delatching position?
i. Aligner, last Carriage Position?
j. Aligner, Failing to shift at all?
k. Binding parts and Assemblies?
l. Lubrication?

These checking points should prove valuable in accurately locating the exact point where trouble is occurring and, therefore, make the correction of the trouble much easier.

CARRIAGE CLEAR

1. FAILS TO SHIFT CARRIAGE TO LEFT:

a. Power Shift Actuating Mechanism failing to latch, Section 4, Adj. 2, Fig. 1, 2, 11 & 12
b. Shift Clutch not engaging properly, Section 3, Adj. 2, Fig. 1 & 4
c. Binding parts
d. Main Clutch not releasing properly
e. Lubrication

2. FAILS TO CLEAR DIALS:

a. Clear Clutch not engaging properly, Section 3, Adj. 2
b. Clear Slide binding, Section 5, Adj. 9, Fig. 4, Section 5, Adj. 8, Fig. 1 & 2, Section 5, Adj. 13, Fig. 3, 4, 5, 1, 2, Section 5, Adj. 9, Fig. 1, 2, 3
c. Clear Pawl out of adjustment, Section 5, Adj. 9, Fig. 1, 2, 3
d. Dial Locks turned to locked Position, Section 5, Adj. 9, Fig. 4
e. Broken Clear Gear on Dial Shaft
f. Cocked Accumulator or Counter Dial

DIVIDEND TABULATOR CROSS TABULATOR

1. FAILS TO SHIFT CARRIAGE TO LEFT OR TO CLEAR DIALS:

Same check as for Carriage Clear

TROUBLE SHOOTING

2. FAILS TO SHIFT CARRIAGE TO RIGHT OUT OF FIRST POSITION:

   a. Shift set-up Lever failing to latch, too little or too much overlatch, Section 8, Adj. 2
   b. Spring off Shift Set-up Levers
   c. Loose Carriage, Shift Rack or Shift Rack Bracket, Section 5, Adj. 1, Section 5, Adj. 13, Fig. 3, 4, 5
   d. Shift Disabling Slide binding or out of adjustment, Section 12, Adj. 5
   e. Shift Latch Control Lever binding, Adjustment, Section 8, Adj. 2
   f. Lubrication of Latch and other parts
   g. Slip Clutch Screws backed out and hitting Latch

3. SHIFTS CARRIAGE ONE OR MORE SPACES TO RIGHT AND QUITS:

   a. Slip Clutch Screws backed out knocking Latch off
   b. Left Shift failing to release, Section 12, Adj. 5
   c. Weak Springs
   d. Latch worn and failing to hold, Section 8, Adj. 3
   e. Lubrication

4. CARRIAGE SHIFTS TO STOP. NO DIVIDEND ENTRY; CONTINUES TO RUN:

   a. Gate Setting Lever not being tripped.
   b. Too much or too little clearance between Tab Actuating Lever and Shift Actuating Lever; see Section 8, Adj. 3, Fig. 1 Section 8, Adj. 3
   c. Too much or too little clearance between Trip Lever and Delatching Lever; see Section 8, Adj. 2, Fig. 1, Section 8, Adj. 3
   d. Right Shift Gear out of time; see Section 3, Adj. 1, Fig. 1
   e. Too much overlatch of Setting Lever on Setting Lever Latch; Section 8, Adj. 6
   f. Right Shift Gear out of time, Section 3, Adj. 1, Fig. 1
   g. Too much overlatch of Section 8, Adj. 6

5. CARRIAGE SHIFTS TO STOP, NO ENTRY, MACHINE STOPS:

   a. Keyboard Locked
   b. No numbers in Keyboard
   c. Keyboard clearing prematurely, Section 4, Adj. 2, Fig. 16
   d. Carriage fails to centralize properly, Section 8, Adj. 2
   e. Add-Subtract Gate binding

6. CARRIAGE SHIFTS TO STOP, ONLY PARTIAL ENTRY OF DIVIDEND:

   a. Roller too close or too wide to Setting Lever; see Section 8, Adj. 4
   b. Binding Relatch Lever Link, Section 8, Adj. 4
   c. Add-Subtract Gate binding
   d. Carriage fails to centralize properly, Section 8, Adj. 2
   e. Weak Spring
   f. Lubrication
   g. Multiplier Keys Release Mechanism interfering, Section 12, Adj. 12

TROUBLE SHOOTING

7. DIVIDEND ENTERS MORE THAN ONE TIME

   a. Setting Lever not relatching
   b. Insufficient overlatch of Setting Lever on Setting Lever Latch, see Section 8, Adj. 4
   c. Delatching Lever binding or caught on Trip Lever; see Section 8, Adj. 3
   d. Worn or loose Roller on Division Drive Gear, Section 10, Adj. 1
   e. Lubrication

8. CARRIAGE SHIFTS THROUGH TABULATOR STOP:

   a. No stop depressed
   b. Tab Actuating Lever loose or very wide to Shift Actuating Lever; see Section 8, Adj. 2, Fig. 1
   c. Shift Clutch failing to release, Section 8, Adj. 2, Fig. 1
   d. Shift Set-up Lever failing to delatch, Section 8, Adj. 2, Fig. 1
   e. Carriage loose, Step 2, Section 5, Adj. 1

9. DIVIDEND ENTRIES, KEY REMAINS LATCHED MACHINE CONTINUES TO RUN:

   a. Key not being delatched by upper end of Gate Actuating Lever; Section 8, Adj. 4
   b. Keystem binding
   c. Key being held down by operator

10. TABULATOR KEY FAILS TO LATCH OR STAY LATCHED:

   a. Worn Latch point
   b. Not enough bite on Latch
   c. Spring weak or off
   d. Latch binding
   e. Lubrication

MULTIPLICATION

1. FAILS TO SHIFT CARRIAGE TO LEFT OR CLEAR DIALS:

   Same as for Carriage Clear. See Page 7/8

2. FAILS TO MULTIPLY IN FIRST CARRIAGE POSITION:

   a. Check adjustment of Add-Subtract Gate Centralizer, see Section 6, Adj. 1, Fig. 1
   b. Binds in Add-Subtract Gate operating Levers, Section 12, Adj. 7, Fig. 1
   c. Add-Subtract Gate Control Adjustments for multiply, Section 12, Adj. 12, to Section 12, Adj. 5 inclusive
   d. Weak or detached Springs
   e. Loose Taper Pins
   f. Lubrication

TROUBLE SHOOTING

3. CARRIAGE FAILS TO SHIFT TO RIGHT:

   a. Carriage Shift Shaft Assembly adjustments, Section 12, Adj. 7, Fig. 8 & 9
   b. Weak Springs
   c. Adjustment of Add-Subtract Gate Stablilizer, Section 12, Adj. 7, Fig. 2
   d. Binds in Carriage Shift Shaft Assembly
   e. Add-Subtract Gate binding
   f. Timing of Right Shift Gear, Section 3, Adj. 1, Fig. 1
   g. Carriage failing to centralize properly

4. CARRIAGE SHIFTS OUT OF TURN:

   a. Too little or too much overlatch of Adjustment Lever on Shift Shaft; see Section 12, Adj. 7, Fig. 8
   b. Worn or loose Roller on Power Set Cam. Section 1, Adj. 1, Fig. 4
   c. Loose Taper Pins or loose Hubs on Shift Shaft Assembly
   d. Shift Clutch binding
   e. Power Set Disabling Lever binding, Section 12, Adj. 12
   f. Lubrication

5. ERRORS, UNDER MULTIPLICATION: (CHECK BASIC ADJUSTMENTS, SEE PAGE 3

   a. Check Feed Pawl for being disabled when Unit shifts; it may be picking up a number in the Shift
   b. Check Cycle Lock Pin for wear or adjustments, Section 6, Adj. 1, Fig. 1
   c. Adjustments for Add-Subtract Gate Control, Section 12, Adj. 2 to Section 12, Adj. 5 inclusive
   d. Check Multiplier Section, sticky Setting Levers, etc., Section 12, Adj. 2
   e. Check Counter; Upper Dials may be correct, Section 7, Adj. 1

6. ERRORS, OVER MULTIPLICATION: (CHECK BASIC ASJUSTMENTS, SEE PAGE 1)

   a. Check Feed Pawl for proper count, Section 12, Adj. 9, Fig. 2 & 3
   b. Holding Pawl for proper latching on Segment, Section 12, Adj. 9, Fig. 2 & 3
   c. Binds in Feed Pawl or Holding Pawl, Section 12, Adj. 9 Fig. 2 & 3
   d. Multiplier Unit Shift adjustments, Section 12, Adj. 3
   e. Check Segment for restoring on Zero Latch
   f. Check selection adjustments, Section 12, Adj. 3 to Section 12, Adj. 3 to Section 12, Adj. 4 inclusive
   g. Broken Pin Board, Section 12, Adj. 4
   h. Broken or weak Detent Spring in Pin Board, Section 12, Adj. 4
   i. False Transfer due to Transfer Pin failing to restore

TROUBLE SHOOTING

7. ERRORS, NEGATIVE MULTIPLICATION:

   a. Check Minus Gate Stops; Gate may be hitting Transfer Gears and causing a false Transfer, Section 6, Adj. 2, Fig. 5, Section 7, Adj. 1, Section 6, Adj. 2, Fig. 5
   b. Cycle Lock Pin worn or out of adjustment, Section 6, Adj. 1, Fig. 3
   c. Add-Subtract Gate Control Levers. Plus Lever may be interfering, Section 12, Adj. 7, Fig. 1
   d. Counter Adjustments. Upper Dials may be correct, Section 7, Adj. 1 to Section 7, Adj. 3 inclusive

8. ERRORS, REPEAT MULTIPLICATION:

   a. Check adjustment of Repeat Lock, Section 12, Adj. 11, Fig. 2
   b. Adjustment of Segment Ring Lock, Section 12, Adj. 11, Fig. 1
   c. Springs
   d. Binding parts
   e. Other checks for Multiplication Errors

9. ERRORS, UPPER DIALS ONLY:

   a. Check Basic Adjustments for addition and Subtraction, see Page 1
   b. Add-Subtract Gate Control Levers for multiplication, Section 12, Adj. 4 to Section 12, Adj. 5 inclusive
   c. Cycle Lock Pin, Section 6, Adj. 1, Fig. 3
   d. Carriage Shift timing, Section 3, Adj. 1, Fig. 1
   e. Carriage failing to centralize properly, Section 12, Adj. 7, Fig. 2
   f. Carriage Adjustment, too tight or too loose, Section 5, Adj. 1

10. ERRORS, COUNTER ONLY:

    a. Check all Counter Adjustments, Section 7, Adj. 1, Section 7, Adj. 3
    b. Carriage Shift may be oscillating or not centralizing
    c. Counter Blocking Slide Adjustment, Section 7, Adj. 1
    d. Dividend Tabulator Counter Blocking Slide Binding, Section 8, Adj. 7
    e. Multiplier Non-Entry Adjustment, Section 7, Adj. 1, Fig. 10
    f. Counter Oscillator Arm, loose studs or worn Cam, Section 7, Adj. 2, Fig. 2
    g. Carriage Shift Rack out of adjustment, Section 5, Adj. 5, Fig. 1

11. MULTIPLIER CLEAR, LOCK-UPS AND FAILURE TO CLEAR OUT SEGMENTS:

    a. Lock-up clearing out Repeat; check Lock and Latch adjustments, Section 12, Adj. 11, Fig. 2
    b. Spring 1131
    c. Adjustment of Unit Shift Rack, Section 12, Adj. 3
    d. Timing of Unit Shift Shaft, Section 12, Adj. 1
    e. Timing of Reset Cam, Section 12, Adj. 1
    f. Zero Latches binding or failing to latch, broken spring
    g. Taper Pins, Screws, Springs, etc., loose or distorted

TROUBLE SHOOTING

12. ERRORS, MULTIPLIER SELECTION

a. For 9 error, check Zero Latches and Multiplier Clear
b. For under-selection, check Setting Levers for sticking, Section 12, Adj. 4
c. Check Setting Pins for proper positioning before segment releases; Section 12, Adj. 4
d. Check adjustment of Zero Release Lever; Section 12, Adj. 4, Fig. 5
e. Broken Pin; Section 12, Adj. 4
f. Weak or broken Detent Spring, Section 12, Adj. 4
g. Adjustment of Escapement Bracket, Section 12, Adj. 3

CHECK LIST FOR MULT UNIT FALLING AGAINST DISABLING LEVER

A. Proper overthrow in comb. No binds in escapement pawls. Proper engagement of shift pawl to shift rack.
B. Check top and bottom shafts for binds. Any slowness of the unit in escaping can cause trouble.
C. Early releasing of clutch caused by short stroking. Clutch should release just as key latches.
D. Multiplication segment feed pawl catching on segments as unit shifts, Friden Service Letter 184 Increase Clearance.
E. Check teeth of comb to see if any are contacting zero-release shaft. From arm on shaft where it fits into pawl #81060.
F. Refer to Tech Tips #19 for bend in booster spring #1204.
G. Proper adjustment of disabling lever .020. Clearance top of segments in home position. Form link #61230. Adjust per Friden Service Letter #118. (Check bite on square stud.)
H. Feed pawl in shift barrel raising above shift rack #81512--shorten link #71836. (This link breaks easily.)
I. Check adjustment of power set cam shift lever #31655--be sure you have drop on keylatch lever with first escapement--Section 12, Adj. 8, Fig. 1, Section 12, Adj. 8, Fig. 2
J. Check adjustment of zero release bail #81335. This will some times hold the unit if it is being pulled too high. Be sure and check for ample clearance of zero latches after you work on the bail.
K. Check clearance between underside of shift race #81512 and shift pawl. Proper adjustment of power set latch and (3) three finger jack can affect this. Some clearance can be obtained by twisting lever #71385; be careful. Check to see if shift rack is bent down on right end. Rack can be shimmed up to clear better.
L. Timing of the multiplier unit shift tooth. Section 12, Adj. 1, Fig. 1

SERVICE PROBLEMS

1. ENTRY IN COUNTER DIALS DURING ENTRY CYCLES

A. Counter blockout not blocking.
B. Enter dividend key not latched on lock bar.
C. Check tension of starting shaft spring.
D. Wide clearance of Tab Key Actuator Lever.

TROUBLE SHOOTING

2. ENTRY OF 9's IN COUNTER DIALS

A. Counter reverse not actuating.
B. Counter reverse operating lever down and items in 1 above.

3. IMPROPER SQUARE ROOT

A. Check proper entry on tabulation.
B. Feed gears not engaging or disengaging with idler gears.
C. Clear lever latch not delatching.
D. Feed pawl not feeding far enough.

CHECKING OF PROGRAMMING UNIT SEPARATELY

Depress Keyboard Clear Key to clear the selection.
Carriage to extreme right. Dials clear.
Select 0625000000 in Keyboard. Plus five times.
Accumulator dials show 00312500000000000000000.
Clear Keyboard. Clear Counter dials.
Depress Division Keys and hold.
Release Primary Arm or Program Starting Arm and then the Division Keys.
Depress clear lever latch.
Pull either the Primary Arm or the Program Starting Arm to the front and hold.
Machine will divide, thus operating the Programming Unit.
Square Root is 25.
Check above items in case of improper Square Root. Use various test problems.

4. IMPROPER "5" ENTRY:

A. Remove lost motion from gear box.

5. CAM SHAFT FAILS TO SHIFT INTO POSITION:

A. Check for wide clearance.
B. Check for lost motion.
C. Check 9th position Feed Engaging Cam for contacting the side of Feed Gear Engaging Arm.
D. Check Cam Shaft out of time.

6. FAILURE OF INITIAL "5" ENTRY:

A. Check Shaft collar too far to the right and cams entry link off Stud B.

B. Check Entry Link not engaging Stud B.
C. Check Cam Shaft out of time.

TROUBLE SHOOTING

7. MACHINE STOPS AFTER TABULATION ENTRY:

   A. Check positioning of the parts.
   B. Check tab key actuator lever for pressing on Enter Dividend Key in home position.

8. SELECTION CANNOT BE MADE AFTER SQUARE ROOT PROBLEM:

   A. Add Key up.
   B. Selecting clear lever not latching.

9. CARRIAGE SHIFT GEAR FAILS TO CENTRALIZE:

   A. Selection Gear meshing improper with Actuator Segments on "5" entry as Carriage shifts to the Left in Square Root operation.
   B. Advance or retard rotational position Feed Engaging Cam that is in position of setting when the shift fails.

10. TAB KEYS RELEASE ON STANDARD TABULATION:

    A. Check Right Carriage End Stop.

11. TAB KEYS FAIL TO RELEASE ON SQUARE ROOT.

12. ENTRY CONTROL GEAR AND TRANSFER GEAR FAIL TO RESTORE.

    A. Check Keyboard clear gate for bottoming.
    B. Starting shaft not relatching.
    C. Lubrication of gears.
    D. Check for broken return spring on the entry control gear.

13. NO ACTION ON DEPRESSION OF SQUARE ROOT KEY:

    A. Check for binds.
    B. Check for broken starting shaft spring.

14. FIGURES REMAINING IN SELECTION AFTER SQUARE ROOT ADD KEY DOWN:

SERVICE NOTES

A. Delatch the delay latch and depress the enter link to release it from the stud before installing the Covers.
B. Check Cam Shaft Timing, should the Carriage Shift Rack be moved laterally.
C. Always use the Division Stop Key down if it is desired to stop the Square Root Operation before the Carriage reached the extreme left.

TROUBLE SHOOTING

D. Division Setting Lever. The SRW is already in motion when division is tripped. On the standard machines the division is relatched at the beginning of the cycle but on the SRW it is delayed to the end of the cycle because relatching would occur before division was completely engaged.

CONTROL KEYS

Note: When operating Square Root, DO NOT rest hand on keyboard.

1. With any operating key depressed, except Square Root and single cycle plus and minus, depress all Square Root operating keys one at a time. Square Root operation must not start.

2. With keyboard lock down, depress all Square Root operating keys one at a time. Square Root operation must not start.

3. Add key down. All 1's in keyboard. Depress '0' Square Root operating key.

   A. Test all operating keys for lock AFTER CARRIAGE STARTS TO SHIFT TO THE LEFT. DO NOT depress the keyboard clear key.
   B. Repeat 3 with each tabulator key down and carriage in first position. Tabulator key must release.
   C. Repeat 3. Pull division stop down after carriage starts shifting to the left. After machine stops, manually clear the dials and depress the plus key. There must be no entry into the accumulator dials. Repeat this test in different carriage positions.

4. Add key up. All 1's in keyboard. Depress '0' Square Root operating key. Keyboard to be locked after the carriage starts moving to the left. Keyboard to be locked after problem is completed. Depress keyboard clear key, clear accumulator dials manually, depress plus key. No number should appear in the accumulator dials.

TROUBLE SHOOTING

COMPLETE TRANSFER

To perform Detent and Pickup checks shift carriage to the last position. Turning Shift Gear By hand, position carriage half way between last position and next-to-last position.

DETENT CHECK:

Turn Dials slightly out of centralized position and release to see that they return to center of detent. Failure to centralize easily may indicate Idler Gears are being held too high by Disengaging Mechanism. Also look for binds in Sensing Fingers and Dial Bearings.

PICKUP CHECK:

Turn Dials backwards from 0 through 9 to 8 and back through 9 to 1. Do this several times. No flicker or attempt to transfer to the next dial to the left should be seen. A movement in the next dial to the left indicates Idler Gears are not being held high enough by the Disengaging Mechanism.

1. Make Pickup Check. If dials try to transfer, the Idler Gears are not being held high enough.
2. Try transferring Minus and Plus in all Carriage Positions with a 1 in the first column of the Main Keyboard. If any dials tend to spin or not transfer correctly, first check Carriage Adjustments and Geneva Clearances, and in particular, #12 Geneva. Do not attempt any adjustment to the Idler Gear Section until all other adjustments have been corrected.
3. Transfer 9's in and out of Carriage using Negative Mult. followed by Accumulative Mult. under power. Do this a number of times.
4. Try Division with a 1 in the first column of the Main Keyboard. Shift Carriage to extreme right and Divide across. If Dials to the left of the blockout point tend to flicker or attempt to transfer, see Section 5, Adj. 8, Fig. 1.

TEST PROBLEMS

SELECTION & ONE CYCLE ADD

With Add Key down, check to see that all Keys release with Plus and Minus Keys.

Note: Hold the Plus Key and the Minus Key down for an instant after each operation. The machine should not make more than one revolution. Release the Key slowly and redepress to check for clutch releasing.

KEYBOARD	DEPRESS CARRIAGE CLEAR	UPPER DIALS	LOWER DIALS
9999999999	Plus Bar	9999999999	1
8888888888	"	18888888887	2
7777777777	"	26666666664	3
6666666666	"	33333333330	4
5555555555	"	38888888885	5
4444444444	"	43333333329	6
3333333333	"	46666666662	7
2222222222	"	48888888884	8
1111111111	"	49999999995	9
1111111111	Minus Bar	48888888884	8
2222222222	"	46666666662	7
3333333333	"	43333333329	6
4444444444	"	38888888885	5
5555555555	"	33333333330	4
6666666666	"	26666666664	3
7777777777	"	18888888887	2
8888888888	"	99999999999	1
9999999999	"	00000000000	0

AUTO. KEYBOARD CLEAR

With Add Key down, check the machine in all operations. The Keyboard should only clear at the completion of every operation except Multiplier Clear. With the Add Key up, the machine should not clear the Keyboard in any operation. The Keyboard should also not clear during any operation when the Add Key is down.

COUNTER

Make the Multiplication test below by using the Plus and Minus Keys; Check the Lower Dials closely to see that each Lower Dial registers correctly on each stroke. Plus 10X individual strokes on the Plus Key. Plus or Minus 9X means Plus or Minus 9 times. Do not hold the Plus or Minus Keys down, but make separate strokes.

TEST PROBLEMS

ADD KEY UP SET ON KEYBOARD 1123454321

CARRIAGE POSITION	DEPRESS CARRIAGE CLEAR	UPPER DIALS	LOWER DIALS
1	Plus 10X	11234543210	10
2	" 9X	112345432100	100
3	" 9X	1123454321000	1000
4	" 9X	11234543210000	10000
5	" 9X	112345432100000	100000
6	" 9X	1123454321000000	1000000
7	" 9X	11234543210000000	10000000
8	" 9X	112345432100000000	100000000
9	" 9X	1123454321000000000	1000000000
10	" 9X	11234543210000000000	10000000000
10	Minus 9X	1123454321000000000	1000000000
9	" 9X	112345432100000000	100000000
8	" 9X	11234543210000000	10000000
7	" 9X	1123454321000000	1000000
6	" 9X	112345432100000	100000
5	" 9X	11234543210000	10000
4	" 9X	1123454321000	1000
3	" 9X	112345432100	100
2	" 9X	11234543210	10
1	" 9X	1123454321	00

OTHER COUNTER TESTS

Place a finger at the left end of Counter Shaft and push with light pressure to the right. Depress and hold Key for a few revolutions, then use the Plus Key. Place a finger at the right end of the Counter Shaft and push with some pressure to the left. Again use the Plus and Minus Keys. The Counter Dial operated by the #1 Primary finger should not fail to rotate. Shift the Carriage to the second position and repeat the above test. Try the test in all Carriage positions. With the Carriage in first position and the Dials clear, depress the Minus Key for placing all 9's in the Counter Dials. Turn the next to last Dial to a #8. Next, for one cycle at a time, rapidly depress the Plus Key then the Minus Key. The Dial to the left of the 8 should show no movement. Turn this 8 to a 9 and move the 8 to the next Dial to the right. Repeat the test with the Plus and Minus Keys. Continue to move the 8 to the right.

Place all 9's in the Counter Dials, have Add Key down and shift the Carriage to the last position. Turn the next to the last dial to an 8. Place a 1 in the first Keyboard column. Depress the Division Keys. Observe as the machine is Dividing, that the Dial to the left of the 8 shows no movement. Repeat the test by shifting the Carriage back to the next to last position and moving the 8 to the next Dial to the right and turning the first 8 to a 9.

Repeat the Division test. Continue to move the 8 to the right.

EXTRA TRANSFER

Repeat each operation several times in each Carriage position. Listen for the Bell to ring on both Minus and Plus Operations. Note if the Bell fails to ring in any Carriage position.

KEYBOARD: 1 locked in

CARRIAGE POSITION	DEPRESS CARRIAGE CLEAR	UPPER DIALS	LOWER DIALS
1	Minus	99999999999999	99999999999
	Plus	All Zeros	All Zeros
2	Minus	999999999999990	99999999990
	Plus	All Zeros	All Zeros
3	Minus	9999999999999900	99999999900
	Plus	All Zeros	All Zeros
4	Minus	99999999999999000	99999999000
	Plus	All Zeros	All Zeros
5	Minus	999999999999990000	99999990000
	Plus	All Zeros	All Zeros
6	Minus	9999999999999900000	99999900000
	Plus	All Zeros	All Zeros
7	Minus	99999999999999000000	99999000000
	Plus	All Zeros	All Zeros

ITEM 10 FULL CARRY OVER

Make the following test and see that the Transfer is complete in all Carriage Positions.

SET 1 ON KEYBOARD, LOCK ON

MULTIPLIER KEYBOARD	DEPRESS	UPPER DIALS	LOWER DIALS
	Neg. Mult.	99999999999999999999	9999999999
	Accum. Mult	All Zeros	All Zeros
	Clear Rep. Mult.		
10	Rep. Mult.		
	Neg. Mult.	99999999999999999990	9999999990
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
100	Rep. Mult.		
	Neg. Mult.	99999999999999999900	9999999900
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult		

FULL CARRY OVER (Cont.)

MULTIPLIER KEYBOARD	DEPRESS	UPPER DIALS	LOWER DIALS
1000	Rep. Mult.		
	Neg. Mult.	9999999999999999000	9999999000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
10000	Rep. Mult.		
	Neg. Mult.	9999999999999990000	9999990000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
100000	Rep. Mult.		
	Neg. Mult.	9999999999999900000	9999900000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
1000000	Rep. Mult.		
	Neg. Mult.	9999999999999000000	9999000000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
10000000	Rep. Mult.		
	Neg. Mult.	9999999999990000000	9990000000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
100000000	Rep. Mult.		
	Neg. Mult.	9999999999900000000	9900000000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
1000000000	Rep. Mult.		
	Neg. Mult.	9999999999000000000	9000000000
	Accum. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		

ITEM 11 OPERATING BARS

Depress each of the following Controls several times and check for sticking, touching cover slots, proper operation, etc.:

Plus Key
Minus Key
Enter Div'd
Mult.
Mult. Clear
Left Shift
Right Shift
Add Key
Neg. Mult.
Accum. Mult.
Left Div.
Stop Key
Right Div.
Both Div.
Carr. Clear
K. B. Clear
K. B. Lock
Counter Control
Mult. Non-Entry
Repeat Mult.

TEST PROBLEMS

OPERATING BARS (Cont.)

Depress each Tabulating Key from one to eight, making sure that each key remains down and restores the key which was already down. Starting with the Zero Tab Key, depress Enter Div'd Key and check for the proper Carriage Tabulation; then the #1 Tab Key, etc., until all Tab Keys are checked for proper operation and proper Dividend entry.

Work any Multiplication problem to prove proper action of Multiplier Keyboard, Multiplier Correction Key, Accumulative Multiplier Key, Negative Multiplier Key and Repeat Multiplication.

CARRIAGE SHIFT

Using the Shift Keys, make sure the Carriage shifts freely into each position both from Left to Right and from Right to Left. Make sure the Shift Keys do not bind, rub on the cover, etc. Hold the Keys down and also use individual depressions. Work any 10 digits in Keyboard by 10 digit Multiplier and check for proper Automatic Carriage Shift. Work any 20 digits by 10 digits in Division and check for proper Automatic Carriage Shift, both to the Right and Left.

POWER SHIFT ACT. MECH.

Shift the Carriage to the extreme Right. Check for the proper operation of the Power Shift Actuating Mechanism by depressing the Carriage Clear Key. Observe that the Carriage begins to shift on the second cycle of the machine. If the Carriage is hesitating at the start or skips a shift now and then, this indicates that the Power Shift Actuating Mechanism is not latching or is not functioning properly. Test this action on each operating Key which returns the Carriage to first position.

AUTO. CARRIAGE CLEAR

Enter figures into the Upper and Lower Dials. Shift the Carriage to the right, depress the Carriage Clear Key. Observe the proper clearance of the Dials when the Carriage returns to first position. Test with the Multiplier Key also.

CARRIAGE CLEAR RACKS & SPLIT & NORMAL CLEARANCE

Try Optional Clear and Split Clear Knobs in both positions and check for freeness, proper detent action, rubbing on cover, etc. Manually clear the Dials; check for proper clearing action. All Upper Dials should clear when the Left Half of Clear Rack is locked in, but only to the position of the Split (7th, 8th, 9th) if Left Half of the Clear Rack is not locked in.

TEST PROBLEMS

ENTER DIVIDEND: DIVISION ALIGNMENT: DIVISION

Work the following problems, and check the action of Enter Dividend, the proper Entry, and the Division results. Check to see that the Division Aligner functions properly by shifting the Carriage back to position #1 after each Enter Dividend operation and before depressing the Division Keys. The Carriage should automatically shift to the right until the figures are aligned. Use #9 Tab Key first, the #8, #7, etc. to test in all Carriage positions.

KEYBOARD	DEPRESS	UPPER DIALS	LOWER DIALS
88888888888	Div. Tab.	8888888888800000000	
	Left Shift		
99999999999	Both Div.	88888888888	888888888
77777777777	Div. Tab.	7777777777700000000	
	Left Shift		
99999999999	Both Div.	77777777777	777777777
66666666666	Div. Tab.	6666666666600000000	
	Left Shift		
99999999999	Both Div.	66666666666	666666666
55555555555	Div. Tab.	5555555555500000000	
	Left Shift		
99999999999	Both Div.	55555555555	555555555
44444444444	Div. Tab.	4444444444400000000	
	Left Shift		
99999999999	Both Div.	44444444444	444444444
33333333333	Div. Tab.	3333333333300000000	
	Left Shift		
99999999999	Both Div.	33333333333	333333333
22222222222	Div. Tab.	2222222222200000000	
	Left Shift		
99999999999	Both Div.	22222222222	222222222
11111111111	Div. Tab.	1111111111100000000	
	Left Shift		
99999999999	Both Div.	11111111111	111111111

AUTOMATIC TRANSFER

Work the following problem to test the transfer action.

Other problems may also be used.

MNE down. Add Key down. Counter Clear and set in non-clearing Position.

TEST PROBLEMS

AUTOMATIC TRANSFER (Cont.)

KEYBOARD	MULTIPLIER KEYBOARD	DEPRESS	UPPER DIALS	LOWER DIALS
0000137000	2400	MULT. KEY	3288	ZERO
		BOTH TRANSFER KEY	ZERO	3288
0000203000	5400	MULT. KEY	10962	3288
		BOTH TRANSFER KEY	ZERO	14250
0014250000	07	MULT. KEY	9975	14250
		NEG. TRANSFER KEY	ZERO	13253

Test to see that the Selection Lever, which operates the transfer, restores after the operation. Do this by depressing the Plus and Minus Key after the Transfer Action from both the Negative and Positive Transfer is completed.

MULTIPLIER KEYBOARD

Check for the proper action of the Selection Keys; the Sector releasing; the Pins setting; the time of Carriage escapement.

AUTO. MULTIPLIER CLEAR: REPEAT MULT

MULTIPLIER KEYBOARD	DEPRESS	UPPER DIALS	LOWER DIALS
1212121212	Rep. Mult.		
	Mult. Key	1346801346531986532	1212121212
	Neg. Mult		
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
2323232323	Rep. Mult.		
	Accum. Mult.	2581369247519640853	2323232323
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
3434343434	Rep. Mult.		
	Mult. Key	3815937148507295174	3434343434
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		

TEST PROBLEMS

AUTO. MULTIPLIER CLEAR: REPEAT MULT (Cont.)

4545454545	Rep. Mult.		
	Accum. Mult.	5050505049494949495	4545454545
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
5656565656	Rep. Mult.		
	Mult. Key	6285072950482603816	5656565656
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
7878787878	Rep. Mult.		
	Mult. Key	8754208752457912458	7878787878
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		
8989898989	Rep. Mult.		
	Accum. Mult.	9988776653445566779	8989898989
	Neg. Mult.	All Zeros	All Zeros
	Clear Rep. Mult.		

SW - MULT. SETTING KEY

Work any multiplication problem by using the Mult. Setting Lever in all three positions. See that it restores properly and that the right multiplication is performed in each position.

M. N. E.

Work any multiplication problem with the MNE down. Check that the Counter Dials do not rotate. Divide out and check that the Counter Dials do rotate.

HALF CENT AND FRACTIONAL

Place all 9's in Keyboard. With Add Key up, depress Plus Key once. Turn all three Clear Knobs to non-clearing position. Place "1" in Multiplier Unit. Pull Repeat Key down. Depress Multiplier Key, then Negative Multiplier Key. The first and last Dials with numbers should change. Others show 9's. Clear the Carriage in First position. Set 5's in all Half Cent or Fractional Dials. Observe that the Setting Twirler drops into position properly. Set "1" in Column 1 and depress the Division Keys. Observe that the Carriage aligns and divides out. Try this test with other figures in Fractional Dials.

SRW

See test on SRW Manual.

TEST PROBLEMS

AUTO. DIVISION STOP

With the #9 and #8 Tab. Keys depressed, divide all 9's by 1's. The Carriage should stop automatically at the 8th position. Continue the test by depressing the #8 and #7 Tab. Keys and divide 8's by 1's. The Carriage should stop automatically at the 7th position. Continue test by using Tab. Keys 7 & 6, 6 & 5 5 & 4, 4 & 3, 3 & 2, 2 & 1.

INTERLOCKS

Test Interlocks by attempting to depress other operating keys during any operation.

SPRINGS

Record under this Item any difficulty caused by a faulty spring. Record unhooked springs, ruptured springs. Record by part number.

BROKEN PARTS

Record under this item any part that may be found broken. Record by part number.

BINDING PARTS

If it is necessary to remove the covers, check the machine carefully for binding parts. Be specific when reporting such conditions by giving the proper numbers and locations of the parts in the machine. The reason for this condition can then be traced.

SCREWS & PINS

If it is necessary to remove the covers, check the machine carefully for loose screws, taper pins, nuts, clips, shavings, or other evidence of careless workmanship. Be specific when reporting such conditions by giving the proper number and locations of the parts in the machine. The reason for this condition can then be traced.

LUBRICATION

If it is necessary to remove the covers, check and note all parts requiring lubrication are properly lubricated. Record under this item any discrepancy caused by improper lubrication.

DAMAGED IN SHIPMENT

Record under this item any damage to the machine which might be due to rough handling, improper packing, or inadequate protection. If there is damage to the machine, always make a claim on the local office of the shipping company. Do this without delay. Record, also, any parts that may be found disengaged.

TEST PROBLEMS

LUBRICATION

A most important function in servicing a machine is proper lubrication. Many machine troubles can be traced to poor lubrication. Too much and too little are both bad conditions and are to be avoided. Too much lubrication may create a condition that causes sluggish action of parts that are actuated by springs and, in addition, serves to collect dirt and dust. Use only one drop of oil in a bearing, as this is sufficient for proper lubrication and is all the bearing will retain.

Use grease sparingly to prevent smearing adjacent parts that would become sluggish if grease is allowed to get on them.

All moving parts of a machine should have some lubrication except where adhesion is a factor. Some parts should be lubricated very sparingly or not at all because oil may create a suction between parts that slide on flat surfaces. When this condition is found, the parts should be flushed with solvent and left to dry.

OIL AND GREASE: Refer to Friden Service Bulletins for the type to use.

A good guide for determining where to use Grease is to duplicate the use of grease on parts as lubricated by the factory.

At the end of many of the adjustment explanations there are notations indicating whether to grease or oil the parts. These notations serve as reminders. Some adjustments do not have these notations, but their absence does not indicate the parts are not to be lubricated.

ACCURACY OPERATING TESTS

ADD DOWN

KEYBOARD	SQUARE ROOT KEY	COUNTER DIALS
0000000625.	Right 5	25
000000625.0	Left 5	25
00000625.00	Right 6	25
0000625.000	Left 6	25
000625.0000	Right 7	25
00625.00000	Left 7	25
0625.000000	Right 8	25
625.0000000	Left 8	25

Also use 144 and operate in the same manner as above. Counter Dials show 12

TEST PROBLEMS

ACCURACY OPERATING TESTS (Cont.)

Set 4294967296 in Keyboard. Add key up.

Depress Right 5 Square Root Key	Counter Dials show 65536.
Depress Left 7 Square Root Key	Counter Dials show 256.
Depress Left 8 Square Root Key	Counter Dials show 16.
Depress Right 9 Square Root Key	Counter Dials show 4.
Depress Left 9 Square Root Key	Counter Dials show 2.

KEYBOARD	ADD KEY DOWN SQUARE ROOT KEY	COUNTER DIALS	ACCUMULATOR DIALS
9999999999.	Right 5	99999.99999	5000000004
999999999.9	Left 5	31622.77660	0032462200
88888888888.	Right 5	94280.90415	3292563890
8888888888.8	Left 5	29814.23969	2536143524
777777777777	Right 5	88191.71036	3889343355
7777777777.7	Left 5	27888.66754	2716751744
66666666666	Right 5	81649.65808	7095453572
666666666.6	Left 5	25819.88897	0884361699
55555555555	Right 5	74535.59924	4670557114
555555555.5	Left 5	23570.22603	1973552197
44444444444	Right 5	66666.66666	2222222225
444444444.4	Left 5	21081.85106	1419884385
3333333333.	Right 5	57735.02691	3507879260
333333333.3	Left 5	18257.41858	0473353922
22222222222	Right 5	47140.45207	3180163579
222222222.2	Left 5	14907.11984	1379391874
11111111111	Right 5	33333.33333	0555555557
111111111.1	Left 5	10540.92553	0354971097

Repeat above test with the add key up, non-entry key down. After each problem, clear the accumulator dials only, manually depress the plus key. The numbers in the accumulator dials and counter dials must match. Clear the selection before starting a new problem by depressing the keyboard clear key.

Set all 9's in the keyboard, add key up, non-entry key down.

Depress '0' Square Root operating key. Depress again after operation is completed without clearing the selection. Repeat three more times. Clear the accumulator dials manually and depress the plus key. There must be ten 9's in both the accumulator dials and the counter dials.